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ABSTRACT

Resources and recommendations are presented to aid teachers in using microcomputers for instructional purposes. Sections in this guide include: (1) an overview of what a computer is and how it works; (2) recommendations for microcomputer care and operation; (3) guidelines for teacher training including who should be trained, the type and amount of training needed, where to get it, and what teacher competencies are recommended; (4) guidelines for student instruction in computer literacy and programming including a computer literacy scope and sequence for grades K-8; (5) guidelines for selecting a computer-based instructional system and courseware; (6) extensive guidelines for evaluating software and courseware including several evaluation forms and checklists; (7) bibliographies of magazines/newsletters, sources of information, software directories, software suppliers, journal articles on microcomputers in education, books, software review journals, and catalogs; and (8) a glossary of computer terms. A form for evaluating the usefulness of this guide is included. (DC)

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The First BYTE

A Teacher's Guide To Classroom Computers

Oklahoma State Department of Education

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The First BYTE

A Teacher's Guide To Classroom Computers

1907

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FOREWORD

The advent of the microcomputer in the classroom has proven to be an interesting experience for educators. The modern technology of the microcomputer has added many options for instruction and for new instructional materials. Teachers and administrators are now faced with many decisions concerning such crucial areas as long range planning for use of computers, teacher training, student literacy skills, system selection, and evaluation of educational software.

We, as educators, will need to identify specific computer literacy skills that will be useful to us as we work toward addressing these concerns for successful integration and application of the microcomputer. It is our hope that this guide will serve as a valuable resource to educators as we investigate this great challenge before us.

Sincerely,

Leslie Fisher

Leslie Fisher
State Superintendent

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TABLE OF CONTENTS

Page

Introduction 1

What is a Computer? 5

Care and Feeding of the Microcomputer 15

Teacher Training 21

Teaching of Computers 31

System Selection 43

Software Evaluation 61

Bibliography 129

Glossary 153

INTRODUCTION

INTRODUCTION

The immergence of the microcomputer on the commercial market during the 1970's has proved to be a great challenge to the American educator. Since the microprocessor appeared on the market at an affordable price, the phenomenon of microprocessing has found its way into many classrooms around the country. According to a survey completed by the National Center for Educational Statistics in April, 1982, approximately 29,000 public schools have at least one microcomputer. Nationwide, students had access to 96,000 microcomputers compared to only 31,000 microcomputers available for instructional use in the fall of 1980.

The teaching of computer literacy and/or is the most prevalent instructional application of microcomputers.

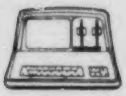
This surge of micro-technology has not been without problems. The pressing needs for more computer hardware, more and better teacher training on microcomputer operation and use, and the need for suitable courseware are concerns constantly addressed by educators across the country.

This guide has been designed to aid the teachers in Oklahoma in addressing these problems and concerns associated with the use of microcomputers.

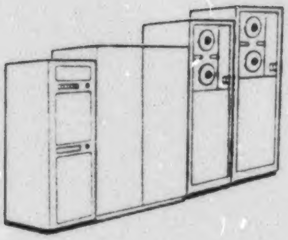
In many instances resources that have been developed by other agencies and/or individuals have been utilized to provide the best possible information.

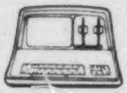
Microcomputer technology provides us with a great opportunity for change. While societal pressures will speed up the process of change, major advances will not be made in the classroom until the majority of educators understand and are themselves supportive of important changes needed in their role.

The classroom teacher has a veritable "feast" in store with many "bits" of information to be exchanged about microcomputers, their capabilities and capacities. And now, the first "byte".



WHAT IS A COMPUTER





WHAT IS A COMPUTER?

To the person just beginning to use microcomputers, trying to understand how a computer works is rather scary. If you are feeling like that, do not feel alone. Most people, other than those who have been working with computers for years, have the same reaction. Because computers have for years used languages that were difficult for the average person to learn and used complex mathematical formulas, we have the idea that only mathematicians can use computers. No longer--the microcomputer has exploded on the scene with a simple language that the average person can understand because, it uses English!!!

To begin with, you must understand that the microcomputer is actually quite stupid. It can only perform functions that someone has "programmed" it to do. While it has tremendous capabilities built into it, without a program, it will just sit there and flash at you, or do nothing.

The information in this chapter is designed to give you some knowledge about microcomputer hardware so that you can make some intelligent decisions when considering the purchase of microcomputers for your classroom, or your school system.

Computer hardware consists of six components. These are:

Processor
Memory
Storage
Input Device
Output Device
Power Supply

Processor

The processor is frequently referred to as the CPU - Central Processing Unit. It consists of two components:

A control unit which carries out the program instruction

AND

The processing unit which is really an electronic calculator that converts complex problems into a series of simple steps, performed at tremendous speed.

Memory

The computer has two forms of memory - the "read only memory" (ROM) and the "random access memory" (RAM). The processor does its work using both kinds of memory.

Now that you are thoroughly confused, let's explain what these two kinds of memory are, and how the processor uses them. The read only memory (ROM) is the memory that is permanently in the machine, engraved on the silicon chips. The ROM contains the programs that give the computer its identity and its ability to respond to information entered at the input device. These contents never change even if the power should go off.

The random access memory (RAM) works only with the power on. This is the part of the computer that contains the applications programs or any information that you have just entered using the input device. Once the electricity is turned off, this information vanishes and must be reloaded from the disk, or reentered, to be used again. RAM is used to store currently used programs and data.

Memory and storage are usually measured in kilobytes. A kilobyte is a thousand characters or numbers. Memory for the various microcomputers can range from a low of 1K (roughly 1000 characters of information), to 256K. Most commonly, however, memory ranges from 16K to 64K. The typical microcomputer used in educational applications might have 48K of RAM -approximately 8,000 words of English text, or roughly 32 double-spaced typewritten pages. Computers vary in their capacity and the user should be careful to select a computer that will have the amount of memory needed to be able to carry out the anticipated function.

Storage

Memory that is contained in the machine is in an immediate (temporary) condition and additional storage of a more permanent nature may be required. This storage can be in the form of cassettes, floppy disks, or hard disk systems.

Cassettes

Cassettes used by the computers are similar to those used to record your favorite record album. Computer data is stored on a magnetic tape much like audio signals are stored. These tapes are extremely inexpensive in comparison to other storage systems, but they are slow and inflexible.

Floppy Disks

Floppy disks are thin pieces of flexible plastic, coated with metal oxides. The 5 1/4" diskettes are the most commonly used disks. They look like 45 rpm records but are thinner and more flexible. Information is stored on them in much the same way that a tape recorder puts sound on a magnetic tape. Most microcomputers can support from one to six disk drives. This means that you can have access to the information on, at most, six diskettes at a single time. For most purposes, this is entirely adequate, as most of these disks will have a capacity from about 70K to more than 500K. For moderate to large school systems using the microcomputer for administrative applications, however, the amount of information available on-line at any one time would be too small to be practical and they should look at hard disk systems.

Hard Disk Systems

Memory in hard disk systems is measured in megabytes (millions of bytes), rather than the kilobytes (thousands of bytes), of the floppy disk system. The most common systems have capacities of 5, 10, and 20 megabytes. Not only does it have a much greater capacity, but the transfer of information from the disk to the computer is many times faster than that of the floppy disk. One disadvantage of the hard disk system at this time is the lack of local services. If a system has a serious mechanical failure, it will almost always have to be returned to the manufacturer for repair and that means several days without the use of the computer - "down time."

Input

Input is what is entered into the computers random access memory (RAM) through the keyboard, another input device, or software. This involves entering a set of instructions into the machine's memory in a language it can understand (programming) or by letting the computer read pre-existing programs that are already encoded on a magnetic tape or disk.

Output

Output in most systems takes two forms:

1. Display on a cathode ray tube (CRT) terminal - a normal video monitor or a TV that has been converted to a monitor.

2. Print-out on a printer attached to the computer. This provides a more permanent record of output. While the print-out is usually in black and white, some new printers have color printout capabilities. Printers range in price from a few hundred dollars to many thousands of dollars. In choosing a printer, you should take into consideration the ways in which this printer will be used. A printer that would be entirely adequate as a part of a learning lab might prove to be very inadequate in administrative applications such as printing out schedules, grades, etc. Keep the following in mind in choosing your printer:

   a. Compatibility with your microcomputer system. Some systems can use only printers produced by the same manufacturer.

   b. Speed. Printers are usually classified by their speed of print in characters per second (cps), lines per minute (lpm) or pages per minute. Small printers of 80-120 cps are good for labs. Printers in the range if 200 cps are good for small loads of administrative applications while large loads may require printers of 300 or 800 lpm.

   c. Type of Print. There are three major types of print that should be considered.

   Dot Matrix - A dot matrix printer has a print head that is composed of small wires that are arranged in a rectangular pattern. The more wires in the pattern, the better the print quality. Speeds of the dot matrix printers range from 80 to 200 cps, and are suitable for most appplications.

Band Printer - A band printer has a steel band which has the character set raised on it. The letters and other symbols are printed by small hammers that drive the print surface into the raised characters. The advantage of the band printer is speed -usually 300 or 600 lpm.

Daisy Wheel Printers - A daisy wheel printer is a printer that is capable of producing typewriter quality print. It is much slower than the others, usually from 25 to 80 cps.

Power Supply

The power supply is usually an integral part of the machine and attached to normal electrical circuitry. (Diagram showing the information coming in and then going into the various parts of the equipment.)

Peripherals

Peripherals consist of those devices that can be added to the computer to enhance its capabilities. Cassette recorders, disk drives, hard disk systems, and printers fall into this category. In addition to these items that are described elsewhere in the guide, the prospective user should keep in mind that many microcomputers can make use of the following:

Modem

A device that can change a computer's binary code into audio tones or sound waves, so that information can be sent or received through telephone wires from one computer to another.

Game Paddles and Joy Sticks

These attach to the computer enabling the user to play certain games, manipulate and create graphics, and perform other functions with the computer.

Voice Synthesizers

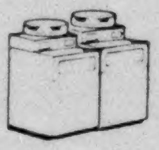
This allows the computer to talk to the user rather than the user having to read the screen of the CRT. Experimental models are also using equipment that allows the user to "talk" to the computer instead of typing in commands. As you can see, these may make it possible for many handicapped persons to use a microcomputer.

Networks

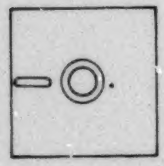
Networks permit the use of cables to connect a variable number of computers together with a "mother unit". The "mother unit" then sends programs to the other units via their connecting cables. This makes it possible to use a single disk drive and a single disk to provide read only memory (ROM) to all of the computers in the network so all users are using the same program.

Multi-user Systems

Some hard disk systems are designed to enable several systems to be connected to the central hard disk system. This enables several stations to have access to the same files simultaneously and to communicate between each other.



CARE AND FEEDING OF THE MICROCOMPUTER



CARE AND FEEDING

While microcomputers really have become very portable and are designed to be durable, some points should be kept in mind as you use your microcomputer.

Hardware Considerations

1. Do not expose your system to either extreme heat or extreme cold. While normal temperature fluctuations will not interfere with operation, extremes can damage your equipment.
2. Protect your microcomputer system from dust by covering with a protective cover when not in use.
3. Keep food and/or drink away from the computer. An accidental spill could result in a very expensive repair bill.
4. If your computer must be moved frequently, be sure it is protected from excessive vibration, dust, and accidental damage.
5. Any changes in equipment should be made only by someone familiar with the system.

Software Considerations

1. Handle disks by the label only. Think of your diskettes as a phonograph record - only more fragile. Do not handle the exposed portion of the diskette with your hands or you might find you've erased your favorite program.
2. Disks are particularly susceptible to damage from heat and/or cold. Never store your disks in the trunk of your car on a hot summer day or you may find that "Space Invaders" has returned to space.
3. Diskettes can be scratched accidentally by dust, etc., so always keep diskettes in their protective sleeves.

4. Make back-up disks of your important disks and store these back-ups in a place where they are protected from temperature extremes and away from equipment that generates a strong magnetic field.

5. When a disk drive is "whirring" and the light is on indicating that it is in use, neither attempt to put a disk in nor take one out.

Each of the different microcomputer systems has specific instructions on its particular operation, i.e., how to load, run, and save programs, etc. Become completely familiar with your system and its capabilities.

Other Recommendations

1. Follow correct power-up/power-down sequence for any equipment configuration when using peripherals.

2. Leave open the doors to disk drives when not in use, thereby relieving pressure on moving parts.

3. Refrain from setting heavy monitors on top of computer console.

4. Disconnect and reinsert properly the interface ribbon-like cable connecting the disk drive to the controller card on the motherboard when moving Apple equipment from one place to another. If the cords are not disconnected from the controller card, they may become partially dislodged, causing a bad connection and possible malfunction.

5. Install a line filter to avoid electrical power surges which may adversely affect equipment operation.

6. Disconnect the power supply before performing any operation inside the computer.

7. Place computers where sunlight will not strike the monitor's screen. This will avoid glare and will require less brightness on the screen. Turning up the brightness on the monitor reduces the life expectancy of the cathode ray tube (CRT).

8. Disconnect the printer from the computer before making any adjustments on the printer, e.g., ribbon. Adjusting the ribbon after sending a print command to the printer can result in injured fingers.

9. Type in the command to clear the screen on the computer in lieu of turning the power switch on and off.

10. Boot the diskette for the computer by typing in the appropriate command. Turning the computer on and off to boot the disk can eventually result in frequent repair to the on-off power switch.

11. Place one hand on a metal part of the computer console case or other metal object to "ground" yourself before touching any chips in the motherboard to avoid destroying information which may be in a chip.

12. Save any information in the computer's memory which you may need later before turning off the power. Information in the random access memory (RAM) will be lost when the power is turned off.

13. Close the file with proper command before removing diskette when programming to avoid losing information.

14. Use a soft felt-tip pen when writing any information on a diskette cover. Using a pen with a hard point could damage the diskette.

15. Store diskettes in rigid containers in a vertical position to avoid warping or bending.

16. Keep disk drive heads clean by using a commercial cleaning kit.

17. Avoid any movement which may generate static electricity when using a microcomputer, e.g., scooting feet across a nylon carpet. Generating static electricity when using the keyboard, handling diskettes, or pressing on chips could destroy information.

18. Avoid constant smoking when using microcomputer. A build-up of residue may prevent the system from operating effectively.

TEACHER TRAINING

TEACHER TRAINING

Now that you have made the decision to enter into the use of microcomputers in your school system, you are probably asking the questions: How much training are the teachers going to need? Which teachers will be trained? What kind of training are they going to need? and, where are they going to get this training?

The amount and type of training will depend on which teachers you are talking about, so let's break our discussion down into the following categories.

Which Teachers Will You Be Training?

All interested teachers should be involved in appropriate training for their level of involvement. Teacher interest is probably the most important factor in successful implementation of microcomputers. An interested teacher can usually get the training they would need to become proficient in the use of computers.

It should be stressed at this point that successful implementation will require the availability of at least one person on-site who is capable of trouble-shooting minor problems and who is thoroughly trained in the use of microcomputers. However, it should also be noted that this person does not have to be a "computer expert" as such. In many instances, this person will be a teacher who becomes interested and seeks out the necessary training to become a resource person.

What Kind of Training?

Computer awareness for all teachers who will be involved in the implementation of microcomputers, to make it possible for them to:

1. be able to operate the hardware
2. be able to identify the different parts of the hardware and know how they operate
3. be familiar with different types of software
4. be able to evaluate different types of software as to usability in their classrooms
5. be able to do simple trouble-shooting in assisting their students in running software
6. have information on the various ways of using the microcomputer as a part of their instructional approach (computer assisted instruction, CAI, and computer managed instruction, CMI, etc.)

Teachers Training Computer Literacy

Elementary Level

1. be familiar with beginning languages such as Logo
2. be able to teach simple basic programming

Secondary Teachers Teaching Basic Programming

1. be proficient in basic programming for the specific equipment they are using in their school system
2. know other computer languages such as Cobol, Pascal, Fortran
3. be familiar with the various courseware and literature available on teaching programming
4. know about employment opportunities in computer-related fields

How Much Training Will Be Needed?

The answer to this question will depend on the level of expertise already possessed by the teachers in your school system, and the level of expertise needed. In most cases however, the following would be a general guide:

All teachers will be involved--

1. basic familiarization: 3 hours minimum
2. familiarization with various kinds of software: 3 hours minimum

Teachers involved in teaching computer literacy--

1. Basic Programming: 10-12 hours

Teachers actually teaching computer programming--

1. Advanced Programming: variable length of time

(Teachers designated as Computer Science Teachers must meet certain certification requirements and it is suggested that teachers become familiar with these.)

Where Will You Get This Training?

Workshops

A plethora of workshops are springing up everywhere, related to the use of microcomputers. Workshops to look for would be those conducted by:

1. Universities
2. State Department of Education
3. Professional Organizations
4. Private Consultants
5. Commercial Distributors

Regular University Coursework

Many universities are offering coursework in the use of microcomputers during their regular semesters - check schedules.

Inservice Sessions

Many qualified people are available to present inservice sessions on-site at your school when requested.

What should you ask for when requesting inservice?

1. Be sure the person you are requesting has the knowledge you are looking for.
2. Make sure the person has experience with the kind of equipment your school is considering or has already purchased.
3. Be sure the workshop will have hands-on work with the computers as a major portion of the workshop.
4. Be sure to specify whether you are interested in awareness, or are interested in a more in-depth offering.
5. Be sure the person or group who will do the training does not have a primary motive of selling specific lines of hardware and/or software, unless your objective is to evaluate those items.

Teacher Competencies

Many state agencies and local education agencies have begun to investigate teacher competencies needed for proper microcomputer utilization in the instructional setting. Setting these competencies and striving for mastery would help insure adequate teacher training.

One exemplary program organized at the state level comes from the state of Virginia. The following list of competencies and evaluation forms are reprinted with permission from the Virginia State Department of Education.

PROPOSED TEACHER COMPETENCIES NEEDED FOR MICROCOMPUTER UTILIZATION IN INSTRUCTION (VIRGINIA)

1. The teacher will define selected computer terminology.
   Descriptive Statement: Such terminology will include the proper names of computer components and terms which indicate procedures and functions e.g., byte, menu, load, interface, RAM, ROM.

2. The teacher will identify the basic components of a computer and describe the function of each.
   Descriptive Statement: Emphasis will be on the functional component systems, e.g., central processing unit, input/output devices, memory.

3. The teacher will load and run a prepared program.
   Descriptive Statement: Skills emphasized are turning on the computer and appropriate peripherals, inserting the appropriate software and following instructions to complete the program.

4. The teacher will use the keyboard to interact with the computer.
   Descriptive Statement: These skills will include the use of special function and alphanumeric keys.

5. The teacher will select and use an appropriate program to solve a given problem.
   Descriptive Statement: This involves problem analysis, selection and use of compatible software and program documentation.

6. The teacher will describe a computer program.
   Descriptive Statement: Emphasis will be on understanding that a program is a series of logical, sequential statements which instruct the computer to perform the operations necessary to solve a problem or complete a task.

7. The teacher will analyze a simple problem and describe procedures to solve that problem.
   Descriptive Statement: Emphasis is on the use of logical thinking and problem-solving skills. This does not require, but may include the writing of a simple program.

8. The teacher will describe the recent development of computer technology and its applications in daily living.
   Descriptive Statement: Emphasis will be on the computer applications in the home, school and community. This may include the history of computer technology.

9. The teacher will describe the potential and limitations of the computer.
   Descriptive Statement: Emphasis will be on understanding the current and possible future capabilities of computers.

10. The teacher will identify and evaluate major ethical, social and economic issues which relate to the use of the computers.
Descriptive Statement: Emphasis will be on the broad influence of computers upon the many facets of society and resultant changes in patterns of thought and action.

11. The teacher will explore computer-related careers and recognize the value of computer skills for future education and employment.
Descriptive Statement: Emphasis will be on the future use of computers in a variety of occupations and prerequisite skills needed for career planning.

12. The teacher will identify electronic databases as information sources.
Descriptive Statement: Emphasis is on information found in databases and methods of information retrieval. Databases such as Guidance Information Service, New York Times Information Bank, the Dow Jones News Retrieval for stocks/bonds information, and Public Affairs Information System may be used. An understanding of banking's electronic funds transfer system may be included.

13. The teacher will describe ways the computer can be used in teaching and learning.
Descriptive Statement: This involves identifying the broad categories of computer use in instruction as well as specific strategies, e.g. drill and practice, simulation, tutorial, problem solving.

14. The teacher will choose the computer as a teaching tool when it improves or enhances instruction and then design lesson plans which effectively integrate the computer into an instructional unit.
Descriptive Statement: Emphasis will be on recognizing whether the computer is the best teaching tool for an instructional unit or strategy. This would include the ability to specifically plan how the computer would be utilized e.g. student time on task at a workstation and management of objectives.

15. The teach will select software technically compatible with hardware.
Descriptive Statement: This will include recognizing RAM memory requirements, hardware features needed such as minimum display line length or graphics capabilities, and required peripherals.

16. The teacher will use evaluative criteria to select software which matches goals and objectives established in the school curriculum.
Descriptive Statement: Emphasis will be on using an evaluation instrument in determining the quality and appropriateness of a software item.

EVALUATION FORM

II. PROPOSED TEACHER COMPETENCIES NEEDED FOR MICROCOMPUTER UTILIZATION IN INSTRUCTION (VIRGINIA)

In order that the Department of Education may evaluate and finalize the proposed "Teacher Competencies needed for Microcomputer Utilization in Instruction," please complete and return.

1. These competencies provide a conceptual framework for computer literacy.

   Yes ☐ No ☐

2. The content in these competencies can be useful for planning and conducting educational programs in computer literacy.

   Yes ☐ No ☐

3. The format of these competencies is logically developed and easy to understand.

   Yes ☐ No ☐

4. General Reactions:

5. Suggestions for Improvement:

Signature ______________________________

Date ______________________________

TEACHING

OF

COMPUTERS

TEACHING COMPUTERS

The type of teaching that will be done on computers will be dependent on what age group you are working with and whether you are interested in teaching the student to be computer literate or are actually involved in teaching computer programming. Other considerations should include the amount of time that will be spent in instruction and the training of the instructor. Some suggestions follow concerning the contents of the two types of instruction--literacy and programming.

Computer Literacy

1. History of Computers

   Development of computer devices
   Significant people in the development of computers
   Development of the silicon chip
   Differences between the generations of computers

2. Computer Hardware

   Identification of the parts of the computer and the way they operate
   Input devices
   Output devices
   Mainframes, Minis, and Micros and the differences between each kind

3. Computer Usage

   Identification of the different ways computers can be used in society today

4. Operational Concepts of a Computer

   Know how information is put into a computer and how the computer handles (processes) this information

5. Using the Computer as a Tool

   - Use prepared programs (software)
     - Load and run programs
     - Modify existing programs
   - Write simple programs in BASIC language or other beginning languages to accomplish specific tasks
   - De-bug programs they have prepared

6. Careers in Computers

   Identification of careers that make use of computers and the training necessary to be qualified for these careers

Computer Programming

Computer programming classes will include all of the material that a literacy class would include plus the following:

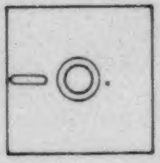
1. Study of problem analysis and formulation of solutions - simple flow charting
2. Familiarization with different computer languages - machine and high level languages
3. Write simple programs in BASIC and/or FORTRAN
4. Load and run packaged programs such as games, simulations, drills and programmed subject matter instruction
5. Study the value of computer in processing information for business and industry and be aware of applications of the computer in airlines, manufacturing, government, the military, and law enforcement
6. Identify dangers associated with the computer such as criminally entering data files, and misuse of information contained in data files such as medical files, credit files, etc.
7. Future role of computers in society

As more microcomputers appear in schools, many school districts or education agencies find themselves identifying goals and objectives in their computer literacy curriculum.

One of the first public school systems to be involved in this endeavor is Cupertino Union School District in Cupertino, California. The Cupertino District (K-8) has an average daily attendance of 13,000 pupils. Although the district is in the heart of the Silicon Valley, developing and implementing a computer literacy curriculum has taken several years.

In 1981, the school board allocated capital expenditure funds to permit wide spread piloting of the computer curriculum during the 1981-1982 school year. The curriculum was evaluated in the spring of 1982 and revised for further recommendation to the school board.

The computer curriculum is reprinted here with the expressed permission of Cupertino Union School District and The Computing Teacher magazine.



IMPLEMENTATION OF THE COMPUTER CURRICULUM

In grades 3-6, the use of a microcomputer will be part of the normal school activities. It will be available for use in the classroom as part of the regular curriculum and by students for individual use. Most computer curriculum objectives at this level can be met by routine classroom use.

In grades 7-8, a specific course in Computer Awareness and Introductory Programming will give students some of the knowledge needed to make wise educational choices in high school and eventual career choices. The computer curriculum objectives can be met in such a course and/or with the inclusion of computer related topics in math, social studies and science classes.

This curriculum, a guide to the ideas students should have an opportunity to learn about computers, has been prepared with the help of many people. Without the support of the Board, administrative staff, teaching staff, and interested members of our community, this curriculum would not be possible.

The principal writer was Bobby Goodson, with the assistance of Jenny Better, Judy Chamberlin, Ron La Mar, Barbara Mumma, Jerry Prizant, Richard Pugh and Cheryl Turner.

Symbols used indicate the level at which given objectives and activities are introduced (I) and reviewed or reinforced (R).

IN SOCIAL STUDIES, STUDENTS WILL:

	K-3	4-6	7-8
1. Become familiar with a computer.			
101 — Become familiar with a microcomputer through its use in the classroom.	I	R	R
102 — Use a prepared program in a microcomputer.		I	R
103 — Describe the historical development of computing devices.		I	R
104 — Tell about the history of Silicon Valley.			I
2. Describe how computers affect our lives.			
201 — Explain ways computers affect our lives.		I	R
202 — List several ways that computers are used in everyday life.	I	R	R
203 — Identify ways that computers are used to help consumers.		I	R
204 — Illustrate the importance of the computer in modern science and industry.		I	R
205 — Identify career fields related to computer development and use.		I	R
206 — State the value of computer skills for future employment.			I
207 — Define the term "data base."			I
208 — Describe some advantages and disadvantages of a data base of personal information.			I
209 — Describe problems related to the "invasion of privacy."			I
210 — Describe ways in which computers are used to commit a wide variety of crimes and how these crimes are detected.			I
3. Describe how computers are used by social scientists.			
301 — Describe how computers are used by sociologists and other scientists.			I
302 — Describe how computer simulations are used in problem solving situations.		I	R
303 — Identify ways in which computers help make decisions.			I
304 — Explain how computer graphics are used in engineering, science, art, etc.			I

	K-3	4-6	7-8
305 — Explain how computers are used as devices for gathering and processing data.			I
306 — List several sampling techniques and statistical methods used in the social sciences.			I
307 — Describe computer applications such as those consisting of information storage and retrieval, process control, aids to decision making, computation and data processing, simulation and modeling.			I
IN LANGUAGE ARTS, STUDENTS WILL:			
4. Define and spell basic computer terms.			
401 — Define (and spell) basic computer terms.	I	R	R
5. Tell about a person or an event that influenced the historical development of computing devices.			
501 — Tell about a person or an event that influenced the historical development of computing devices.		I	R
6. Describe how computers are used in information and language related careers.			
601 — Explain the meaning of "word-processing."			I
602 — Use a computer as a word-processor.			I
603 — Describe some of the ways computers are used in the information and language related careers.			I
IN SCIENCE, STUDENTS WILL:			
7. Define "computer" and "program."			
701 — Tell what a computer is and how it works.	I	R	R
702 — Describe the historical development of computing devices as related to other scientific devices.		I	R
703 — Know the characteristics of each generation of computers.		I	R
704 — Differentiate among computers, calculators and electronic games.		I	R
705 — Differentiate between analog and digital devices.			I
706 — Differentiate among micro-, mini-, and main frame computers and identify the five major components of any computer.		I	R
707 — Define (and spell) basic computer terms.	I	R	R
708 — Define software and hardware and list two examples of each.		I	R
709 — Define "computer program."		I	R
710 — Explain why a computer needs a program to operate.		I	R
711 — Define "input" and "output" and give an example of each.		I	R
712 — Recognize the relationship of a program, or input, to the result, or output.		I	R

	K-3	4-6	7-8
713 — Explain the basic operation of a computer system in terms of the input of data or information, the processing of data or information, and the output of data or information.			I
714 — Evaluate output for reasonableness in terms of the problem to be solved and the given input.		I	R
715 — Recognize the need for data to be organized to be useful.			I
716 — Describe how computers process data (searching, sorting, deleting, updating, summarizing, moving, etc.).			I
717 — State what will happen if instructions are not properly stated in the precise language for that computer.		I	R
718 — List at least three computer languages and identify the purposes for which each is used.			I
719 — State that BASIC is one of the languages used most commonly by microcomputers.		I	R
720 — Explain the existence of several variations in BASIC.		I	R
8. Explain how computers are used by scientists.			
801 — Describe the computer's place in our growing understanding of science.			I
802 — Show how a scientist would use a computer.			I
803 — Explain how computers are used in predicting, interpreting and evaluating data.			I
804 — Show that computers are best suited to tasks that require speed, accuracy and repeated operations.			I
805 — Describe situations which limit computer use (cost, availability of software and storage capacity).			I
806 — Identify common tasks which are NOT suited to computer solution.	I	R	R
807 — Explain how computer models are used in testing and evaluating hypotheses.			I
9. Use a computer to accomplish a simple task.			
901 — List several fundamental BASIC statements and commands.		I	R
902 — Differentiate between random computer commands and computer programs.		I	R
903 — State the difference between system commands and program statements.			I
904 — Use a prepared program in a microcomputer.		I	R
905 — Create a simple program in BASIC.		I	R
IN MATHEMATICS, STUDENTS WILL:			
10. Explain that the design and operation of a computer is based on standard logic patterns.			
1001 — Explain that a computer design is based on standard logic patterns.			I

	K-3	4-6	7-8
1002 — State the meaning of "algorithm."			I
1003 — Explain what is being accomplished by a given algorithm.			I
1004 — Follow and give correct output for a given algorithm.			I
1005 — Describe the standard flow chart symbols.		I	R
11. Demonstrate how a computer could be used to accomplish logical or arithmetic tasks.			
1101 — Read and explain a flow chart.		I	R
1102 — Draw a flow chart to represent a solution to a proposed problem.		I	R
1103 — Order specific steps in the solution of a problem.		I	R
1104 — Translate mathematical relations and functions into a computer program.			I
1105 — Use the computer to accomplish a mathematical task.		I	R
1106 — Evaluate output for reasonableness in terms of the problem to be solved and the given input.		I	R
1107 — State that data must be organized to be useful.			I
1108 — Describe the techniques computers use to process data such as searching, sorting, deleting, updating, summarizing, moving.			I
1109 — List several ways computers are used to process statistical data.			I
1110 — Explain the statement: "Computer mistakes" are mistakes made by people.			I
If these activities are combined into a single Junior High Computer Literacy elective, they could be regrouped with the following objectives:			
THE STUDENT WILL:			
A. Develop a vocabulary of common computer terms.			
401 (707) — Define (and spell) basic computer terms.	I	R	R
705 — Differentiate between analog and digital devices.			I
701 — Tell what a computer is and how it works.	I	R	R
704 — Differentiate among computers, calculators and electronic games.		I	R
706 — Differentiate among micro-, mini-, and main frame computers and identify the five major components of any computer.		I	R
708 — Define software and hardware and list two examples of each.		I	R
711 — Define "input" and "output" and give an example of each.		I	R
207 — Define the term "data base."			I
B. Be familiar with the history of computing devices and the development of computers.			
103 — Describe the historical development of computing devices.		I	R
702 — Describe the historical development of computing devices as related to other scientific devices.		I	R

	K-3	4-6	7-8
501 — Tell about a person or an event that influenced the historical development of computing devices.		I	R
104 — Tell about the history of Silicon Valley.			I
703 — List the characteristics of each generation of computers.		I	R
C. Develop an understanding of how computers are used.			
201 — Explain ways computers affect our lives.		I	R
202 — List several ways that computers are used in everyday life.	I	R	R
203 — Identify ways that computers are used to help consumers.		I	R
302 — Describe how computer simulations are used in problem solving situations.		I	R
303 — Identify ways in which computers help make decisions.			I
803 — Explain how computers are used in predicting, interpreting and evaluating data.			I
807 — Explain how computer models are used in testing and evaluating hypotheses.			I
1109 — List several ways computers are used to process statistical data.			I
306 — List several sampling techniques and statistical methods used in the social sciences.			I
601 — Explain the meaning of "word processing."			I
801 — Describe the computer's place in our growing understanding of science.			I
204 — Illustrate the importance of the computer in modern science and industry.		I	R
304 — Explain how computer graphics are used in engineering, science, art, etc.			I
305 — Explain how computers are used as devices for gathering and processing data.			I
307 — Describe computer applications such as those consisting of information storage and retrieval, process control, aids to decision making, computation and data processing, simulation and modeling.			I
804 — Show that computers are best suited to tasks that require speed, accuracy and repeated operations.			I
805 — Describe situations which limit computer use (cost, availability of software and storage capacity).			I
208 — Describe some advantages and disadvantages of a data base of personal information.			I
209 — Describe problems related to the "invasion of privacy."			I
210 — Describe ways in which computers are used to commit a wide variety of crimes and how these crimes are detected.			I
D. Learn about computer-related career opportunities.			
205 — Identify career fields related to computer development and use.		I	R

	K-3	4-6	7-8
206 — State the value of computer skills for future employment.			I
301 — Describe how computers are used by sociologists and other social scientists.			I
603 — Describe some of the ways computers are used in the information and language related careers.			I
802 — Show how a scientist would use a computer.			I
E. Gain a non-technical understanding of how computers function.			
1001 — Explain that a computer design is based on standard logic patterns.			I
713 — Explain the basic operation of a computer system in terms of the input of data or information, the processing of data or information, and the output of data or information.			I
716 — Describe how computers process data (searching, sorting, deleting, updating, summarizing, moving, etc.).			I
1108 — Describe the techniques computers use to process data such as searching, sorting, deleting, updating, summarizing, moving.			I
715 (1107) — Recognize the need for data to be organized to be useful.			I
1110 — Explain the statement: "Computer mistakes" are mistakes made by people.			I
806 — Identify common tasks which are NOT suited to computer solution.	I	R	R
709 — Define "computer program."		I	R
710 — Explain why a computer needs a program to operate.		I	R
712 — Recognize the relationship of a program, or input, to the result, or output.		I	R
714 (1106) — Evaluate output as to its reasonableness in terms of the problem to be solved and the given input.		I	R
717 — State what will happen if instructions are not properly stated in the precise language for that computer.		I	R
718 — List at least three computer languages and identify the purposes for which each is used.			I
719 — State that BASIC is one of the languages used most commonly by microcomputers.		I	R
720 — Explain the existence of several variations in BASIC.		I	R
F. Learn to use a computer.			
101 — Become familiar with a microcomputer through its use in the classroom.	I	R	R
102 (904) — Use a prepared program in a microcomputer.		I	R
1002 — State the meaning of "algorithm."			I
1003 — Explain what is being accomplished by a given algorithm.			I
1004 — Follow and give correct output for a given algorithm.			I
1005 — Describe the standard flow chart symbols.		I	R
1101 — Read and explain a flow chart.		I	R

	K-3	4-6	7-8
1102 — Draw a flow chart to represent a solution to a proposed problem.		I	R
1103 — Order specific steps in the solution of a problem.		I	R
901 — List several fundamental BASIC statements and commands.		I	R
902 — Differentiate between random computer commands and computer programs.		I	R
903 — State the difference between system commands and program statements.			I
905 — Create a simple program in BASIC.		I	R
1105 — Use the computer to accomplish a mathematical task.		I	R
1104 — Translate mathematical relations and functions into a computer program.			I
602 — Use a computer as a word-processor.			I

END■

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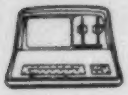
SYSTEM SELECTION



SYSTEM SELECTION

With the rapid growth of computer uses in our society it is essential that educators practice professional planning processes in their selection of computer systems which will be used in the instructional program.

A plan to integrate computers into the instructional program may be built around three purposes and categories of use. These three purposes are:

1. To help teachers teach and students learn.
2. To make new topics of instruction possible and accessible to students.
3. To expand the intellectual capabilities of students.

The three categories are:

1. The computer as media. The computer is used to deliver instruction and instructional content. This is often called the tutorial use. Typically, this category includes CAI (Computer Assisted Instruction) such as computer games, simulations, drill and practice and elemental problem solving.
2. The computer as an object of instruction and as a tool. This is often referred to as the tool use. It includes learning how computers work, how they are programmed, and what they can be used for. It involves their use as word processors, in information processing and retrieval, and for computer managed instruction.
3. The computer as a new way to think, design, create, or solve. This is often referred to as tutee, or tool maker use. It means the computer is used to expand the intellectual capabilities of the user. It is a result of learning to use a tool so that its use affects one's views, ideas, thought processes, mental structuring and approaches to problem solving.

One state education agency has developed a comprehensive planning strategy for use by public schools. The following plan for action was developed by the Texas State Department of Education in 1982. It is reprinted for use by Oklahoma teachers with the expressed permission of the Texas Education Agency, March, 1981.

GUIDE FOR SELECTING A COMPUTER-BASED INSTRUCTIONAL SYSTEM

From Texas Education Agency Document,
February, 1982

This guide has been developed to serve school districts in making decisions about computer-based instructional systems and selecting systems which meet defined needs. A computer-based instructional system (CBIS) includes hardware, software, documentation, facilities, inservice training, management and evaluation procedures. A glossary of terms is on page 22.

The following steps should be considered essential to making decisions about using the computer in the instructional program. A quick guide is included as Appendix E.

STEP 1: SPECIFY THE INSTRUCTIONAL GOALS AND OBJECTIVES

Instructional goals and objectives must be defined prior to considering any instructional tool or strategy to be used in the instructional setting. Establishing goals and objectives is required by a local district to meet accreditation standards. A single set of learner objectives, scope and sequence, or skills continuum for each content area should be the guide for all instruction in that content area. The computer is one tool which may be used to address instructional objectives through direct instruction or management of instructions.

District Actions:

Identify the instructional objectives and state those which will be addressed through use of a computer-based instructional system.

STEP 2: ASSESS THE STUDENT LEARNING NEEDS

Student learning needs should be assessed in relation to the instructional objectives. Learning needs are defined as the difference between the desired learning outcomes for students and their current performance relative to those outcomes. There may be many measures of indicators of student performance, but these must reflect accomplishment of the defined objectives. On-going assessment procedures used by the district are appropriate for defining student needs, as well as other procedures which might measure particular objectives to a greater degree of specificity.

After completion of the needs assessment, the student population(s) will be identified. All other decisions regarding the selection of a computer-based instructional system should be made relative to the identified needs and the population evidencing those needs. This might be all students at a particular grade level(s) or a subpopulation.

District Actions:

- Identify the assessment tool(s) and the information used for local instructional improvement including, as appropriate, Texas Assessment of Basic Skills data, criterion-referenced information, standardized achievement test scores, and other diagnostic and descriptive information.
- Identify the particular population to be addressed, including grade level and distinguishing characteristics of the students.

STEP 3. REVIEW THE DISTRICT'S CURRICULUM FRAMEWORK AND THE MEANS USED TO IMPLEMENT THAT FRAMEWORK

A basic framework for curriculum must exist before the appropriateness of using a computer-based instructional system can be judged. If computer literacy (including computer programming), or the computer as an object of instruction, or the computer as a tool maker have been determined to be learning needs, then a curriculum framework will probably not be in place and will need to be developed. All instructional materials and media should be correlated with these frameworks.

District Actions:

- Review curriculum frameworks or develop them as necessary.
- Correlate textbooks and other instructional material in use with the framework and explore how a computer-based system will correlate and complement these.

STEP 4: DETERMINE THE APPLICATIONS OF THE COMPUTER

The computer has many uses or applications which are defined by the particular software or courseware selected. However, some computer-based instructional system applications will be more appropriate than others for addressing the previously identified student needs.

The term computer-assisted instruction (CAI) typically includes four applications: drill and practice, tutorial, simulation, and problem solving.

A computer-managed instructional (CMI) system may offer diagnosis, prescription, data collection, data reporting, and correlation of instructional materials to objectives.

Other applications such as the computer as an object of study or for expansion of the intellect might be more appropriate for the identified population. Such applications should be studied to determine which will maximize the potential for alleviating the identified learning needs.

District Actions:

- Review alternative applications for the computer.
- Define the rationale for the application selected.

STEP 5: REVIEW AND SELECT SOFTWARE

Find or develop computer software which will meet the need(s) identified.

If CAI applications are desired, there may be a range of software, called courseware, which will present information in such a way as to cause students to attain specified objectives.

If CMI is more appropriate, there are software packages available for correlating instructional materials by objective, diagnostic testing, placement and record keeping. CMI software should not be confused with courseware; their content, structure and purposes are different. Some courseware may have integral management programs.

If applications other than CAI and CMI are chosen, there are computer programs available to teach computer literacy, programming, data processing, word processing, and the use of the computer as a tool maker.

Appendix A contains general guidelines for software or courseware evaluation and selection. The selection of software requires knowledge about instructional objectives and computer capability. Examination of software for purpose, cosmetics, logic, sequencing and pedagogic considerations is in order. Familiarity with computer input and output devices (keyboards and video screens) and other computer capabilities (i.e., graphics and branching) is necessary. There are many courseware selection guides and evaluations available to teachers (see Appendix C).

Reviewing computer software should be a team endeavor where in the whole computer program is reviewed. It is a time intensive activity and should be treated systematically.

District Actions:

- Review courseware or other software under consideration using a comprehensive set of criteria or questions (see Appendix A) which address critical issues regarding courseware selection.
- Review evaluations of courseware available from organizations, journals, and other sources (see Appendix C).

STEP 6: REVIEW AND SELECT THE COMPUTER SYSTEM

The computer system contains (1) the hardware, (2) the documentation, and (3) the set of software (computer programs) which cause the computer to operate and perform the functions desired. The computer itself is that part of the system that executes the directions contained in the software. Documentation is the set of written instructions which describe how to operate the hardware and software components. All three components of the computer systems must be complementary.

The selection of a total system depends on the purpose for which it will be used. The intended initial uses should not preclude planning for other applications of the system. Such planning may include the use of other courseware, other kinds of applications (i.e., word processing, CMI, student accounting), other instructional purposes (computer programming) and other possible configurations) computer networks or additional components). These future or concurrent uses should be identified before making the final selection.

The user should select the hardware which best matches the courseware to be used and is the most appropriate for the student users. The earlier courseware selection will generally limit the selection of the computer system.

Before reviewing computer systems, specifications addressing the following areas should be reviewed to give guidance to both the seller and the buyer:

- Instructional objectives and courseware selected.
- Description of the users of the system--student population, grade level(s), number of students, and teachers.
- Proposed instructional settings--regular classroom, learning resource center, laboratory, etc.
- Needs for hardware maintenance, software maintenance, and training.
- Potential growth and the system's capability for adding components, such as printers, disks, memory, communications, etc.
- Requirements for software utilities such as languages, sort routines, computer-managed instructional programs.
- Requirements for additional and future uses of the system.
- Compatibility with other instructional materials or existing computer system.

Appendix B is a guide for selecting the system (hardware, documentation, and software). Although it is not comprehensive, the primary issues are included.

District Actions:

- Review multiple hardware systems using Appendix B and the above specifications as a guide.

STEP 7: CONDUCT STAFF DEVELOPMENT FOR ADMINISTRATORS, TEACHERS, AND OTHER INSTRUCTIONAL STAFF

Prior to introducing the computer into the instructional setting, teachers and other staff should be adequately prepared to use the system, including courseware, documentation, and hardware. General competencies the teachers should exhibit prior to using a computer-based instructional system are:

- Understanding of the objectives of the instructional program and how the computer-based system will enhance student achievement of the objectives. Knowledge of how achievement will be evaluated.

- A working knowledge of ocmputer terminology, especially that relating to the hardware.
- Ability to identify and resolve problems students may encounter in using the computers.
- Understanding of any special software/courseware needed to initiate instruction.
- Understanding of the system's documentation.
- Awareness of capabilities such as test preparation, availability of student performance data, etc.
- Awareness of the limitations of the computer system, including the hardware and software.
- Proficiency in the use of a computer system which will be used.

District Actions:

- Develop a staff development plan which addresses, as appropriate, the above competencies.
- Establish a time line for the school district to implement the computer-based instructional system.
- Collect information about staff development, including cost, location, and the provider.

STEP 8: DEVELOP A PLAN FOR MANAGEMENT AND EVALUATION

A part of the planning process must involve consideration of the management of the instructional system.

Because any instructional system involves more than a single teacher in a classroom, the management of the system must define the roles and responsibilities of the teachers, the principals, and other instructional team members and the technical specialists necessary to smooth working of the system. The instructional team members may include such personnel as librarians (media or resource specialists) and subject matter or program specialists. The technical specialists may include computer specialists (programmers, maintenance personnel, etc.).

As in any good management plan, the tasks necessary to reach the objectives are carefully defined so that assignments may be made and carried out. Communication links must be strong, continuous, and timely.

Information about the management process, the communication link, and any breakdown of communication must be generated in a timely fashion. It is this information which feeds the process of evaluation.

Most school districts have on-going systems for measuring student outcomes. Continuing use of the computer must be justified by its impact on students. Evaluation of student progress based upon measures external to the computer system should be conducted at least annually and perhaps more often.

Using feedback about how the management system is working is another aspect to be addressed in an evaluation plan. Other considerations in the evaluation plan should be to examine the courseware selection criteria and its continuing appropriateness, amount of time the computer is used, additional peripherals needed, time-saving for teachers, and the cost of the program.

A variety of other implementation details such as budget, new job descriptions, and community awareness must be addressed with the advent of a CBIS. Appendix D introduces just a few of these issues.

District Actions:

- Develop a management plan to
  - Identify the role of all staff using the computer-based instructional system.
  - Identify support personnel (including maintenance staff) and their roles.
  - Establish schedules for staff training.
  - Establish schedules for the use of computers if more than one class or staff person is to use the computer.
  - Establish procedures for training students about "hands-on" use of the computer, as required by the computer application chosen.
- Develop an evaluation plan to:
  - Identify instruments to be used to evaluate student progress and student testing.
  - Establish a time line for evaluation of student progress and student testing.
  - Determine procedures to evaluate the cost vs. benefit of the computer-based instructional system.
  - Evaluate the courseware selection criteria initially used to determine if it is comprehensive and appropriate to the current knowledge level of users.

APPENDIX A
Courseware Selection

1. Does the courseware match your predetermined instructional objectives?

2. Does the specific application (i.e., problem solving, drill and practice, tutorial) of the courseware have promise for meeting the identified student learning needs?

3. Does the courseware prescribe prerequisite or entry level skills?

4. What are the experiences of other users with the courseware?

5. Has the courseware been previously evaluated in terms of its effectiveness in improving learner outcomes?

6. Can the courseware be adapted to meet changing needs both in the curriculum and in the way student needs might be more effectively addressed?

7. Does the vendor provide courseware updates and error correction? What is the cost of this service?

8. Is the courseware pedagogically sound and is there a diversity of instructional approaches?

   - What is the reading level used in the courseware and is it appropriate for the intended student users?
   - For what length of time will the students used the courseware--in individual sessions--and how often?
   - What the overall visual effect of the material?
   - Are the pictorial simulations used where appropriate?
   - Is the instructional material designed well?
   - Do the contents strands contain a sequence of lessons ranging from easy to difficulty?
   - Does the teacher manual and/or student manual complement the courseware?
   - Is adequate documentation at the appropriate reading level provided with the courseware?
   - Is on-line direction provided to the student while interacting with the computer?
   - Are component steps in solving a problem provided to the student?

9. Is the courseware user-controlled?
   - Can there be random selection of courseware content?
   - Can the user branch to various parts of the lesson for help, glossary, etc. and get back again?
   - Are the next steps clear?
   - Does the user control the reading rate and pace?
   - Can the student decide to revise work previously completed during a session?
10. How is feedback to students provided?
    - Are explanations provided on why incorrect response was unacceptable?
    - Are incorrectly spelled anwers accepted? Is the spelling error corrected in feedback to the student?
    - What happens when the student input is not recognizable by the computer?
    - Are wrong answers treated appropriately--not demeaningly?
11. Does the courseware provide for permanent management and scoring or is it lost when the machine is turned off?
12. Is the courseware easily and quickly loaded into the computer?
13. Is the name and address of the courseware developer/vendor provided if a user has questions, recommendations, or problems.
14. Will teacher training be required to use the courseware and who will provide the training?
15. Is the material actually on the market so it may be readily acquired, as opposed to beign available only for demonstrastion or review?
16. Are "backup" software and courseware disks, cartridges or tapes provided at a reduced price?

APPENDIX B
System Selection (Hardware, Documentation and Software)

1. What software is provided with the system? What software can be added? What additional hardware is required for adding new software capability?

2. What peripheral components are required for the courseware selected? What peripheral component capacities and speeds are required to achieve objectives? For example, the time it takes to load programs into the computer memory from a tape cassette may annoy a user. Computer response time is a critical factor. Other hardware such as touch panels, special keyboards, printers, speech synthesizers are available. They may require special considerations about space, cumbersome cords and plug in items, or change the RAM (Random Access Memory) available for actual computing functions.

3. Are components designed with the user in mind? Keyboards come in special and standard arrangements, may or may not contain upper and/or lower case letters and may contain special symbols. Video displays may be easy to view or have glare and other problems. Computers may be portable and durable or be designed to be more or less permanent.

4. How will software be improved or corrected (software maintenance)? Who is capable of and authorized to change the software?

5. Can the computer system support graphics? Are graphics appropriate for improving learner outcomes? Color, graphs, maps, lines, shapes, and simulations can be displayed with some computer systems. There are several factors which may have impact on graphic clarity and viewability, such as resolution in the cathode ray tube (i.e., "fuzzy" screen).

6. Is there a capability for storing or saving programs and data? Some storage is performed by transferring information from the computing unit to disks or tape cassettes. Such capabilities, including necessary peripherals, may require additional expenditures.

7. Is the computer memory capacity adequate? Is it expandable? RAM (Random Access Memory) is the usual designation for useful memory (expressed as 16K, 32K, etc.). The ease and expense for increasing this memory capacity must be considered in terms of anticipated requirements. The same consideration should be given to disk storage capacity.

8. What computer languages can the system use? Not all computers use the same language or "dialects". BASIC or any other language may vary across several vendors and thus may not be compatible with different computers.

9. Has a cost comparison of components been made? Similarly capable and constructed parts of hardware such as disk drivers, CRTs, microprocessor boards, cabinets and connectors may be compatible across manufacturers and can vary significantly in cost. Cost comparison of components or systems is advisable. Discounts are usually available through existing ECS contract or state contracts.

10. What is the availability and cost of hardware maintenance, service and backup? Warranties from a reliable manufacturer, the speed and cooperation with which repairs and services are to be performed, and the cost of each are among the most critical decisions. Different service contracts are options to be be considered. Are extended warranty provisions available? Computer equipment has a reputation for high reliability, but down time, even if short, can be detrimental in the learning environment. Will extra hardware on site or a complete system loan agreement be required to replace units being repaired? What is the experience of other users?

11. Are your facilities, power availability, and security arrangements adequate? Housing, placement and protection of computers, disk storage, etc., should be planned prior to their selection.

12. Is the system capable of communications with another computer system? If the system may be used for other purposes such as an input terminal to another computer, then communications features (hardware and software) will be required.

13. What training will be provided by the vendor? (The importance of training should be stressed in bid specifications.) What additional inservice training is planned?

14. Are all components such as cables, connectors necessary to operate the computer with all its peripherals, included in the bid? Is delivery and on-site installation required? Is it included in the bid price?

APPENDIX C
Implementation

1. What factors will influence the instructional setting(s) or location of equipment such as the funding source, staff competency, student needs, number of students per device, security, etc.? What are other factors which may be affected by instructional setting decisions? For example, is the microcomputer appropriate? Should one use a simple network? How much equipment is needed? What additional wiring or power is required, etc.?

2. What is the need for training of different kinds and for different types of personnel (teachers, aides, administrators, parents, students)? For example, should teachers be capable of performing some elementary maintenance? Checklist of common simple problems with previously successful remedy options may be helpful.

3. What consideration will be given to parent attitudes? Should they be made aware of how the school intends to make the computer available to students? What explanatory meetings and documents are needed for such community groups as the PTA, Chamber of Commerce, etc. to ensure understanding and support of the program?

4. What new responsibilities for management must be assigned? Who will handle equipment trouble calls or complaints, schedule access to equipment, handle public relations, etc.?

5. What backup or redundancy is critical for hardware, software, and courseware? Are additional complete devices going to be available to replace those not functioning? Can common, easily replaced parts be kept on hand for quick repair?

6. What are considerations for budgetary planning beyond acquisition of hardware and courseware? For example, do recurring costs for courseware, maintenance, supplies, and periodicals need to be considered? Will job descriptions and salaries have to reflect new functions to be performed? New budget and expenditure classifications for accounting will be necessary.

7. Are professional periodicals and other pertinent literature on data processing, computer science and computers in education made available to administrators, teachers and students? Where will you obtain or access the variety of needed training materials for administrators, teachers, students and community groups?

8. What documentation and reports will you require? For example, what documentation will be required to direct users in the operation of the hardware, software (i.e., file maintenance, sort capabilities), and courseware.

APPENDIX D
The Quick Guide

1. Identify the instructional objectives and state those which will be addressed through use of a computer-based instructional system.

2. Identify the assessment tool(s) and the information used for local instructional improvement including, as appropriate, Texas Assessment of Basic Skills data, criterion-referenced information, standardized achievement test scores, and other diagnostic and descriptive information.

3. a. Review curriculum frameworks or develop them as necessary.

   b. Correleate textbooks and other instructional materials in use with the framework and explore how a computer-based system will correlate and complement these.

4. a. Review alternative applications for the computer.

   b. Define the rationale for the application selected.

5. a. Review courseware or other software under consideration using a comprehensive set of criteria or questions (see Appendix A) which address critical issues regarding courseware selection.

   b. Review evaluations of courseware available from organizations, journals, and other sources (see Appendix C).

6. Review computer systems using Appendix B and the specifications on pages 12-13 as a guide.

7. a. Develop a staff development plan which addresses the competencies identified.

   b. Establish a time line for the school district to implement the computer-based instructional system.

   c. Collect information about staff development, including costs, location, and the provider.

8. a. Develop a management plan to:

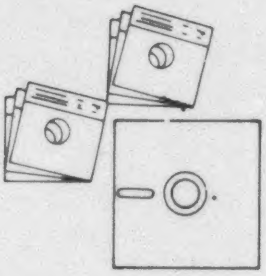
   - Identify the role of all staff using the computer-based instructional system.
   - Identify support personnel (including maintenance staff) and their roles.
   - Establish schedules for use of computers if more than one class or staff person is to use the computer.

- Establish procedures for training students about "hands-on" use of the computer required by the computer application chosen.
- Address CBIS implementation issues (see Appendix D).

b. Develop an evaluation plan to:

- Identify instruments to be used to evaluate student progress.
- Establish a time line for evaluation of student progress and student testing.
- Determine procedures to evaluate the cost vs. benefit of a computer-based instructional system.
- Evaluate the courseware selection criteria initially used to determine if it is comprehensive and appropriate to the current knowledge level of users.

SOFTWARE EVALUATION



INTRODUCTION TO SOFTWARE

Evaluation and selection of instructional courseware for the microcomputer are probably the greatest concerns of classroom teachers. Although the electronic gadgetry of the machines is attractive to students, teachers have found that unless the materials are instructionally sound the microcomputer cannot be used effectively. In other words, if it does not work as quality instructional material off the computer it will not work on the computer.

Teachers have growing concerns about the quality of documentation and print materials that accompany software packages. Appropriate uses of technology incorporated in the electronic courseware is also a valid concern.

In this selection of "The First Byte", several valuable pieces of information have been provided for teachers to use in the evaluation process. An article by Dr. Vicki Blum Cohen outlines many important evaluation factor and specific criteria to be addressed. A guide furnished by the Alberta Department of Education provides a look at one agency's comprehensive plan for evaluation of instructional courseware. In addition, several evaluation forms are provided for consideration of use in the individual district's evaluation process.

COMPUTER COURSEWARE DEVELOPMENT AND EVALUATION

Criteria for the Evaluation of Microcomputer Courseware

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INTRODUCTION

As the use of microcomputers proliferates in educational settings, there is a great need to determine what exactly is "good" instructional courseware and what is inadequate. With small, cottage-industry firms being the most common producers of instructional software (courseware), often our educational lessons on the microcomputer are dependent upon what an enterprising programmer considers good instructional design. Courseware packages are frequently developed in a pragmatic or "artistic" fashion, without any systematic statement of objectives or analysis of the learning tasks required. As a result, programs of questionable educational value flood the market; space-war games and How-to-Compute-Your-Taxes tend to be the most common programs available. When a true educational software package emerges, there are no accepted criteria as to what comprises an effective program for instructional purposes.

At present, no widely agreed-upon standards or criteria exist which would help to define what an effective software program is. Developing standards and evaluation procedures has been a difficult problem in that there has been a wide range of opinions over what the "ideal courseware product" should be and what we should be aiming for in the way of courseware as technology becomes more capable of extending its potential (Roblyer, 1981). In order for these standards or criteria to be effective guidelines, it is necessary to isolate those attributes unique to the microcomputer and those that should be included in the design of all instruction. The two types of attributes would then become a checklist for those evaluating or developing courseware for the microcomputer; they would help to pinpoint those elements that are basic characteristics of effective instruction and those characteristics necessary to consider when utilizing the microcomputer as an instructional tool. This list would help to ensure quality control of courseware.

When trying to determine those criteria which should be considered in the design of instructional software, a few issues become apparent.

First, it is important to differentiate between the two kinds of attributes that need to be considered: (1) those that are generic to all media of instruction, and are recommended strategies to use for instructional design; and (2) those that are necessary to consider specifically in the design of software for the microcomputer and potentially affect learning outcomes in a unique way.

Second, each attribute should be clearly observable so that during the evaluation process it is possible to determine if the attribute has been included in the design of the program. This means that an evaluator or developer should be able to look at the courseware and quickly determine if the attribute has been included in the program's design.

Table 1

Necessary Attributes to Consider
In Designing Courseware for the Microcomputer

Generic to Instructional Design

1. Target audience specified
2. Learner entry competencies specified
3. Rationale, goals, and objectives specified
4. Objectives stated behaviorally
5. Objectives stated in terms of the learner
6. Objectives include higher-order skills
7. Learners informed of objectives
8. Range and scope of content adequate to achieve program's intents
9. Preinstructional strategies used:
    - Pretests
    - Advance organizers
    - Title at beginning of unit
10. Instructional text formatted for easy reading
11. Concept learning employed in instructional approach
12. Vocabulary used appropriately for learner
13. Graphics embedded in content
14. Graphics used appropriately
15. Demonstration of the exercise provided
16. Teacher's Manual provided
17. Instructions clearly stated for student
18. Evaluation components provided

Necessary to Design of Courseware

1. Curriculum role used:
    - Adjunct
    - Mainline
    - Management only
    - Other
2. Mode of interaction employed:
    - Drill and practice
    - Tutorial
    - Game
    - Simulation
    - Problem-Solving
3. Student sequenced through the content:
    - Nonlinear
    - Varied by teacher/student
4. Instructional text formatted for screen display
5. Graphics embedded in the content
6. Graphics used appropriately
7. Cues and/or prompts used
8. Action occurs on the screen
9. User control granted to learner
10. Computer-Managed Instruction employed
11. Feedback used appropriately
12. Records stored on magnetic devices for future retrieval
13. Content designed to be altered
14. Random generation used
15. Packaging designed for component parts
16. Teacher's Manual and Student Manual provided
17. Technical design used:
    - Quick response time
    - Quick loading time

Table 1 lists the two kinds of attributes that should be used in development and evaluation: (1) those that are generic to instructional design, and (2) those that are necessary to consider in the design of courseware for the microcomputer. These attributes were developed during a full year by a review team that was evaluating and examining microcomputer courseware being marketed for school use. During the course of this evaluation project, at the Microcomputer Resource Center at Teachers College, Columbia University, this review team developed a strong sense of what "minimal" standards were and what desired but realistic standards should be. The team was composed of two instructional designers, two subject-matter experts, and two technical experts--a recommended team to have in the design and/or evaluation of courseware (Roblyer, 1981).

It should be noted when looking at Table 1 that there is no one-to-one correspondence between these two lists, and that item number one in the "Generic to Instructional Design" list bears no relation to item number one in the "Necessary for Design of Courseware" list. These two lists represent what the review team felt were desirable and realistic attributes that most software programs should contain.

Each attribute that is necessary to consider in the design of courseware for the microcomputer will be discussed briefly below.

CURRICULUM ROLE USED

The role that the microcomputer will play in the classroom is unique, and it cannot be viewed as just another medium of instruction. Rather, the computer has the potential of modifying the curriculum and absorbing much of the labor-intensive responsibilities which the teacher has traditionally maintained. By reducing many of the time-consuming tasks that the teacher is required to do, and by functioning as a surrogate "tutor," the microcomputer can lower the teacher-pupil ratio and allow a greater amount of individualized instruction to occur. Courseware packages for the microcomputer can function in three capacities in the classroom:

1. As supplementary "adjunct" applications whereby teachers use them as supplements to the regular curriculum. Problem-solving, simulation, and drill and practice are examples of adjunct applications of the microcomputer.

2. As a "mainline" or basic course that is used to teach students a complete curriculum unit. No input from the teacher is needed, and the microcomputer functions as a "tutor" teaching concepts and providing drill and practice on these concepts. Usually, records are maintained and all instruction is managed by the computer.

3. As a management system whereby all the records for a curriculum unit are stored and managed by the computer. No instruction is

provided with this application of the computer; its role is to provide accurate records on whether each student has mastered specific objectives and pinpoint the level at which each student is functioning.

Other applications of courseware programs for the microcomputer might be:

1. As a pre-programmed authoring device for teachers and students to create their own programs.

2. As a programming course on computer literacy whereby students learn how to program the computer.

3. As an assessment device whereby tests are given on the microcomputer, and the student's responses are immediately scored and reported to the teacher.

MODE OF INTERACTION EMPLOYED

How a courseware program for the microcomputer functions in the curriculum is dependent upon how the student interacts with the subject-matter and computer. The various modes of interaction are unique to the microcomputer in that the student is able to interact directly with the computer and receive immediate feedback after the response. The five types of interactions that can be employed using the microcomputer are:

(1) *Drill and Practice*, which is designed to supplement the regular instruction received elsewhere by providing a means by which concepts presented and developed in the classroom can be practiced and refined at the computer.

(2) *Tutorial*, which is intended to stand alone as an instructional entity in the curriculum and is not used to supplment classroom teaching, as is drill and practice. This requires that the program teach rules and concepts embodied by the subject matter, evaluate the student's comprehension of these concepts, and provide practice in the specific skills taught.

(3) *Gaming*, which is a situation where students have to know certain facts, perform certain skills, or demonstrate mastery of certain concepts; winning depends upon mastery of these cognitive skills.

(4) *Simulation*, which is where certain elements of social or physical reality are abstracted and the student must interact with and become part of that simulated reality. Simulations should be used after basic concpets and principles are learned, to integrate them into the context of a meaningful problem.

(5) *Problem-solving*, which involves the combining of previously learned rules into a new higher-order rule that solves the problem and generalizes to an entire class of stimulus situations embodying other problems of the same type (Gagne, 1977).

The five modes of interaction listed above are those most frequently used in courseware applications and are necessary aspects to consider in its design.

STUDENT SEQUENCED THROUGH THE CONTENT

A unique and interesting attribute of courseware design is the sequencing of a student through the content material. The issue of a program being nonlinear adds a new dimension to instructional design. Basically, the content is organized in a similar fashion across all media with task-analysis, natural unit sequencing, and chronological progressions being common methods. But how the student progresses through the content can be unique in microcomputer courseware, since a linear path is neither necessary nor desirable. Courseware can be designed to allow the student to choose his or her own sequence and follow a different route on each pass through the content. The design of the courseware program will determine who has control over the sequence--the program, the student, or the teacher. The more that the sequence is fixed by the program in a linear path, the less likely a student can vary the sequence.

An important student option is to be able to exit from an activity and enter a new one, if so desired. A book can be closed, a chapter can be skipped, a workbook page can be ignored. On the microcomputer, it is extremely frustrating to be forced through one activity after another with no choice but to continue. The option then becomes one of turning the machine off and walking away. Bork (1979) claims that the ability of students to control the sequence of material within a learning sequence makes the computer a unique instructional device. The dialogue becomes richer and more interactive when the student can move back and forth between instructional sequences based upon individual needs.

The other option available in courseware design is to have the teacher determine the sequence for a student. The teacher would then be capable of individualizing the sequence for each student. This attribute is another essential way that the courseware can be designed to capitalize on its unique capabilities.

INSTRUCTIONAL TEXT FORMATTED FOR SCREEN DISPLAY

It is essential that the instructional text be formatted on the screen for easy reading. The nature of the screen is such that long sentences become difficult to read and understand when viewing the screen. Most video monitors used with microcomputers have a 250-line resolution, or about half the resolution quality we are accustomed to seeing in print materials. Reproducing the hard edges required by alphabets and numbers is therefore a technically difficult task for microcomputers unless they are programmed for rather large print. As the size of the print increases, however, the amount of memory available for other tasks is depleted. Because the print is inherently difficult to read, it is especially important that the formatting and frame display not add to the viewing difficulty. Lines of text must have space between them, long passages should be left to textbooks and magazines, and the screen should be completely clear before each new display, rather than have frames fill up line by line.

GRAPHICS EMBEDDED IN THE CONTENT

Those graphics that are embedded in the instructional content (or are an integral part of the instruction) contribute to the learning process by presenting a visual model of the information to be learned. Graphic (as opposed to textual) representation of concepts takes advantage of a powerful capability of the microcomputer and is often easier for children to store in their memories. It can facilitate recall by inducing them to actively construct their own mental representation of the information they are trying to learn (Flavell, 1977; Wittrock, 1980).

Graphics used to enhance either the content or the feedback are helpful motivational devices but presume that the presentation is print-oriented. This use of graphics relies predominately on print or numbers to convey ideas, while providing a graphic supplement to enhance the content. A visual representation is not included to facilitate learning or induce recall. An important consideration is to ensure that the graphics do not distrct from the content being presented and interfere with the program's intents.

Bork (1977) claims that graphics are an integral part of an instructional sequence. One of the most valuable contributions of iconic representation in learning is the building of student intuition or insight. In trying to develop problem-solving skills, graphical visualization becomes an extremely important component. A common student difficulty is a failure to generate a "map" or series of maps of possible processes and directions in solving a problem. A diagram, flowchart, or visual representation of the problem becomes imperative. Finally, the motivational aspects of graphics cannot be overlooked.

GRAPHICS USED APPROPRIATELY

In considering the whole issue of graphics, it must be admitted that for the most part humans are visually illiterate and not very skillful in the use of visual images in learning. We live in a highly verbal society, whereby our educational system is based upon verbal and written communications. Very little information is conveyed through visual representation (Bork, 1977). Therefore, it is not surprising how little is known about iconic visualization in the learning process. Due to this illiteracy, it must be admitted that it is very difficult to evaluate whether graphics are, in fact, used appropriately.

However, there are certain features which can be considered when evaluating the quality of the graphics in a software program.

- Are the graphics relevant for the user's age and ability level?
- Do the graphics avoid being distracting?
- Do they support the program's intents or detract from the instructional content?
- Are the graphics clear?
- Do the graphics add interest?
- Are the graphics in color?

These questions should help to determine whether the graphics will enhance the program's overall instructional quality and if they are used appropriately within a context we can judge.

CUES AND/OR PROMPTS USED

Just as a tutor can employ various techniques to help stimulate a student's recall, so can a good courseware program insure that cues for retrieval are available to the learner. These "cues" or "prompts" usually jog the memory, and this contact gives rise to the feeling of recognition (Flavell, 1977; Gagne, 1977).

To adequately cue correct responses, the courseware program should respond in an interactive way. When new concepts or terms are being introduced, the program should maximize the number of cues to insure a correct response. In contrast, when a student knows the subject well, he or she can respond correctly without cues. The technical term for withdrawing the cues is "fading." This should be done in a gradual process, because if cues are faded too rapidly, the student will make many incorrect answers (Markle, Eigen, and Komoski, [illegible]61). For example, if a student is trying to spell "trade," the [illegible]st prompt may be "_rade," the next one "__ade," the next one "___de," and the last one "____e."

This capability is one that the microcomputer can utilize based upon individual performance. It is a unique, interactive feature that can be employed to facilitate learning.

ACTION OCCURS ON THE SCREEN

There is very little research in this area, but an essential attribute of any courseware program is to see some kind of graphic movement on the screen other than just words or numbers. The graphic capability of the microcomputer allows for a wide range of animated movement. Unfortunately, this aspect is often ignored in educational settings, resulting in boring, stagnant programs. Anyone who has walked into an electronic arcade recently knows the exciting capabilities of the microcomputer in terms of graphics, color, and movement.

USER CONTROL GRANTED TO LEARNER

Perhaps user control is one of the greatest capabilities of the microcomputer. The whole notion of interactivity is realized when courseware allows the student to weave his or her own educational environment. This can be done by granting the learner control over certain aspects of the program. The following questions will help to determine the extent to which the user can control the program.

- Can the student alter the rate of presentation so that he or she can control the text rolling on the screen or the rate that problems are presented?
- Can the student exit the program at any time?
- Can the student determine where entry into the program must begin?
- Can the student review instructions at any time?
- Are options available in the program such as "HELP" or "HINT"?
- Can the student redesign any parameters of the program, such as change the number of examples provided, determine when a test is taken, or specify how many problems are to be completed?

COMPUTER-MANAGED INSTRUCTION EMPLOYED

If a courseware program is to utilize the full capabilities of the microcomputer effectively, it should have a sophisticated management system. Individualized instruction traditionally has been difficult to institute, due to the labor-intensive tasks involved. Because of this, educators are starting to become aware of the computer-managed instruction (CMI) as a means of alleviating the time-consuming demands of managing individualized instruction.

By managing the student's performance, the microcomputer should: (1) collect and store data from the learning situation; (2) diagnose each student's status based upon performance; (3) prescribe activities to the student by moving a student forward to the next unit or assigning a student activities to eliminate a deficiency (commonly known as branching); and (4) provide reports on student progress (Baker, 1981).

An important feature of the management system is its branching capabilities. Virtually every subject matter can be taught at several levels of difficulty, and the computer has the capability to branch to the level of program best suited to the student based upon previous performance (Spitler and Corgan, 1979). The potential uses for branching are multitudinous, and given the greater individualization via recycling and enrichment that this capability allows, branching should be a commonly used feature in all software programs.

In evaluating a program's branching capabilities, an important aspect to be aware of is when the program "loops back" to a set sequence for review. Often the producer claims that the program is branching, when in fact a simple loop-back procedure is being utilized. Actual branching occurs when a student moves to a different instructional sequence based upon his or her responses and individual needs.

Another important consideration when evaluating a management system is the technical ease of using the program. If the courseware program is cumbersome and difficult for the teacher to operate due to an elaborate management system, the primary purpose of the system is defeated --to alleviate the teacher of time-consuming tasks when individualizing instruction.

FEEDBACK USED APPROPRIATELY

Research on feedback has shown that the main function of feedback is not to strengthen or reinforce correct responses but to locate errors and provide information so that the learner can correct them in his or her mind. Providing only positive feedback is less facilitative during acquisition of instruction than giving negative feedback (Anderson et al., 1972; Barringer and Gholson, 1979; Hartley and Lovell, 1978; Kulhavy, 1977). Therefore, research recommends that feedback should be used primarily after wrong responses. It is not necessary after most correct answers. In addition, behavioral psychologists have shown that an intermittent or partial reinforcement schedule maintains the highest rate of learning. Not only is it unnecessary to reinforce each response, it is preferable not to do so (Homme and Tosti, 1971).

Appropriate use of feedback is an important issue in evaluating courseware. The following should be considered:

1. Feedback should be non-threatening and not "yell" at the student for a wrong answer. A "friendly" courseware program is one that is interminably patient without penalizing the student.
2. Feedback should be immediate and inform the student whether the answer is correct or incorrect and what the correct response is. It is also helpful to explain why the response is wrong.

3. Feedback should not over-reinforce correct responses with elaborate praise every time the student answers correctly. For very young children or slower learners, an abundance of positive feedback might be necessary at first, but an option should be available to fade out the constant feedback.

4. Feedback should remediate. A tutorial or explanation is often necessary to help correct the student's answers. The student should also have some way of matching his or her incorrect answer against the correct response.

5. Feedback should not reinforce wrong answers by providing a more rewarding graphic for a wrong response than for a correct response.

6. Feedback should be relevant for the user's age and level.

RECORDS STORED ON MAGNETIC DEVICES FOR FUTURE RETRIEVAL

The microcomputer can interface with two forms of electronic storage devices--magnetic cassette tapes, which use an audio tape recorder, and digital magnetic disks, ranging from small floppy disks to large hard disks used in one or more disk drives. The advantages of the magnetic disks far outweigh the higher price of a disk drive over the audiocassette recorder. The disk allows cumulative records for each student to be stored and immediately accessed at a future time. A student can complete a lesson, turn the machine off, and, later in the day or week, the teacher can quickly retrieve the student's records. Storing permanent records on cassettes is a much slower and less efficient process. Therefore, maintenance of records on cassettes is rarely done and usually when the machine is turned off, all records are lost. The increased ability of the disk to store much more information and to access it much more quickly adds to the quality and feasibility of implementing computer-managed instruction on the microcomputer.

CONTENT DESIGNED TO BE ALTERED

An option available to courseware programs on the microcomputer is to have the content designed to be altered by the teacher or student adding to it. Some programs take advantage of this feature by having the teacher and/or student create his or her own word lists and spelling lists, for example, which are then stored on the disk and become part of the program. This flexilibity allows the program to be adapted in many different types of situations and can be easily integrated into the curriculum. This feature is not widely utilized but has great potential for educational purposes.

RANDOM GENERATION USED

A simple but extremely useful attribute that can be utilized in courseware programs is the random generator. This built-in feature will generate a universe of items at random so that no one set of exercises, words, or items will ever appear in the same order the next time they are generated. A simple way to see if a program is using random generation is to go through a few exercises in a lesson, note the order of the problems, turn the machine off, and start the same lesson again. If the problems are generated in a different order, you know that random generation is being used. If the same exact problems appear, random generation is not being used. This feature is a very useful and helpful device that should be utilized in courseware programs, especially those that are of drill and practice application.

PACKAGING DESIGNED FOR COMPONENT PARTS

Although good packaging is essential to all instructional materials, microcomputer courseware contains some unique aspects which should be examined. First, it is important to consider how the component parts (disks and/or cassettes) can be packaged so that they do not fall out of the container. Second, the disks and/or cassettes must be packaged so that they can be distributed among many teachers, being that the large programs are designed to be used across grade levels. The packaging should take this into account and be designed in such a way that several copies of the Teacher's Manual are provided. All disks and cassettes should be clearly labeled according to subject area, lesson numbers, and grade-levels.

TEACHER'S MANUAL AND STUDENT MANUAL PROVIDED

The Teacher's Manual should contain: (a) sufficient information to teach the teacher how to technically manipulate the program; (b) classroom strategies for using the program; and (c) specific instructional activities to integrate the program into the curriculum. Also needed is a Student Manual to help the student access and technically manipulate the program. To alleviate fears and resistance, both guides should be extremely well-organized, clearly stated, and provide a step-by-step approach.

TECHNICAL DESIGN USED

An important attribute to consider is the technical design of the program.

- Does the design allow for quick response time so that a user can input responses quickly and not be held back by the software?

- Does the design allow for quick loading time so a student is not continually waiting for a segment of the program to be loaded from the disk to the computer's memory? If a student is left sitting idle at a terminal for many minutes while the disk drives whir and a message on the screen says "LOADING . . . ," a teacher can soon be in trouble (not to mention the equipment and the disks).

SUMMARY

Microcomputer courseware ultimately will determine the success or failure of microcomputers in the classroom. There is a paramount need to develop not just "minimal standards" but standards that will act as guidelines to help producers, evaluators, and consumers determine what quality software is.

The attributes that have been discussed pinpoint those criteria that should be included in the design of instruction for the microcomputer. They could become a potential checklist for producers, developers, or evaluators of courseware, and they help to isolate certain unique features of the microcomputer which should be utilized to enhance interactivity in the design of computer-based instruction. These criteria offer a set of standards by which instructional software can be judged; and, if used in a formative way, they could increase the quality of the courseware being produced.

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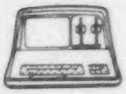
EVALUATOR'S GUIDE
FOR
MICROCOMPUTER-BASED
COURSEWARE



Developed by the

PROGRAM DEVELOPMENT DIVISION

of

ALBERTA EDUCATION

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TABLE OF CONTENTS

I. INTRODUCTION PAGE

A. Purpose 79
B. Process 79
C. Description of the Instrument 80

II. PROGRAM EVALUATION FORM

A. Intents 81
B. Content 81
C. Instructional Format 84
D. Technical Design 89
E. Additional Comments 98

III. DISK EVALUATION FORM

A. Description 99
B. Developer's Rationale 99
C. Summary of Intents 100
D. Description of Entry Competencies 100
E. Evaluation of Ease of Use by Teacher and Student 100
F. Management System 101
G. Observations of Student Users 101
H. Disk Evaluation 102
I. Summation 102
J. Recommendations to the Producer 102
K. Recommendation 102

IV. GUIDELINES FOR MAKING RECOMMENDATIONS 103

V. NECESSARY FEATURES OF TUTORIAL/DRILL PROGRAMS 105

VI. DEFINITIONS 107

VII. GLOSSARY OF TERMS 108

Acknowledgment is given to the Northwest Regional Education Laboratory and the EPIE Institute for their work done in preparing evaluation instruments and guidebooks. We benefited considerably from their experience.

I. INTRODUCTION

A. PURPOSE

Except in instructional situations where student programming is the primary activity, microcomputers can be used to assist the instructional process effectively only to the extent that quality courseware is available. This Evaluator's Guide and the associated evaluation forms have been designed to assist teachers in identifying such courseware.

The development of the guide and the evaluation instruments have been based on the philosophical approach that description and evaluation of courseware should be separated. This has been done in the three major sections of the instrument - CONTENT, INSTRUCTIONAL FORMAT AND TECHNICAL DESIGN.

B. PROCESS

The process of evaluation conducted by Alberta Education involves the Program Development Division and the Computer Technology Project's Clearinghouse. As priorities are identified by the Program Development Division, the Clearinghouse solicits courseware from publishers for evaluation. It then has the materials described and assessed by teachers who have the appropriate knowledge in the subject area under consideration and who have received training in the use of the evaluation instrument.

These evaluations result in one of three decisions:

a. The material is identified as worthy of further evaluation.
b. The material is identified as having limited use in the classroom (Supplementary).
c. The material is rejected.

Courseware identified in "a" is evaluated further by the Program Development Division for congruency to the program of study and may be designated as a "Prescribed", "Recommended" or "Supplementary" learning resource for Alberta schools. Prescribed and Recommended materials are acquired and distributed through an agency identified by Alberta Education. All courseware evaluations are filed in the Clearinghouse and results are made available to Alberta schools.

C. DESCRIPTION OF THE INSTRUMENT

Courseware currently being published may come in a number of configurations.

a. A disk may contain a number of "stand-alone" programs. For example, programs on spelling, identification of capital cities and review of basic number facts may be available all on one disk.

b. A disk may contain a number of programs tied together under the same basic goals but each having different objectives. For example, a disk may have four programs - addition, subtraction, multiplication and division of decimals.

c. A disk may contain one main program, for example, a simulation of a scientific experiment.

d. Two or more disks may be tied together into a package or series. For example, six disks reviewing arithmetic fundamentals may be combined together into a single package with a management system.

As the basic item of purchase is the disk, IT IS THE DISK which has been made the basis of evaluation of this instrument.

There are two parts to the evaluation instrument - the *PROGRAM EVALUATION FORM* and the *DISK EVALUATION FORM*.

A *PROGRAM EVALUATION FORM* is generally completed for each stand-alone program on the disk. The form has descriptions and evaluations of a program's intents, content, instructional format and technical design. Each stand-alone program on the disk receives an evaluation that is independent of other programs on the disk.

A disk containing a number of programs tied together under a common goal will generally have each of the programs evaluated separately. However, when the programs are designed in such a manner that the only noticeable difference between them is in the content and all other factors of instructional format and technical design are identical, one *PROGRAM EVALUATION FORM* may be used for all the programs.

A *DISK EVALUATION FORM* is used to evaluate the overall DISK. It contains the identification of the disk (title, publisher, etc.), and a description and evaluation of any management system that may exist. It also contains a summative evaluation of the disk's entire contents, instructional format and technical design. A summational statement and a recommendation are at the end of the form.

II. PROGRAM EVALUATION FORM

A. INTENTS

OBJECTIVES

List the objectives that the program is intended to achieve and indicate if they are stated or inferred.

Objectives are the behaviours that the learner manifests as a result of involvement with the materials. The evaluator should ask himself what it is the learner will be able to do after using these materials?

Examples of objectives: Learners will be able to add fractions with common denominators; learners will be able to recognize the names of the capital cities of Canada; learners will be able to identify the correct use of "their, there and they're"; learners will be able to identify the chemical elements given the abbreviations of the elements.

B. CONTENT

CONTENT DESCRIPTION

Write a narrative statement which will describe the following aspects of the content.

Program Contents

Describe the educational contents of the program (topics, skills, concepts).

1. What are the topics/skills/concepts covered in the program? (range)
2. What is the progression of the presentation? How are the units ordered? (sequence)
3. Describe the depth of treatment. What does the treatment include? (explanation, rules, examples, illustrations, drills, tests, etc.)

Example: This program covers three types of addition of fractions. Students begin with addition of common fractions with the same denominators, proceed to addition of fractions where one fraction has a denominator that is a factor of the other (e.g., 2 and 6, 3 and 12) and finish the program with addition of fractions with completely different denominators (e.g., 3 and 4, 5 and 7). Improper and mixed fractions are not included in the program. The presentation of each topic includes one page of introduction, two examples and a brief drill. A statement of rules is available. The program ends with a test on all three skills.

Example: This program covers three types of improper word usage:

1. there/their/they're 2. too/to/two 3. good/well

Each example is presented through the use of a rule, one example of correct usage and one example of incorrect usage. A drill on all three types is included at the end of the programs.

User Support Materials

User-support refers to STUDENT support materials.

1. Describe the extent of any student materials such as pre-instruction activities, work sheets and follow up activities that are included with the disk.
2. Indicate if the materials are integral to the design of the package or if they are optional.

CONTENT EVALUATION

Write a narrative statement which will evaluate the content described earlier. Some questions to be addressed include:

Range

1. Is the range of the content appropriate for the target audience?
2. Is the range of the content effective in achieving the intents of the program? Is sufficient content covered? Is too much covered?

Sequence

3. Is the sequence of presentation appropriate for the target audience? Is the size of the increment appropriate?
4. Is the sequence effective in achieving the intents of the program?
5. Does the sequence remain consistent/appropriate during and after branching?

Depth	6.	Is the depth appropriate for the target audience?
	7.	Is the depth effective in achieving the intents of the program? - Is the material presented in sufficient depth and intensity so that learning will take place? - Are definitions and explanations available where necessary? - Are sufficient examples and illustrations used? - Is sufficient practice available?
Accuracy	8.	Is the content accurate? Does it contain factual errors, an invalid model in a simulation, an oversimplified model or series of examples, inaccurate graphs or displays?
	9.	Is the content current?
Clarity	10.	Is the content presented in a clear and concise manner which is appropriate for the target audience?
Bias	11.	Is the content balanced or biased? - e.g., improper language usage? - e.g., ethnic or social class references? - e.g., references to violence? - e.g., references to sexual or social roles? - e.g., age portrayals? - Does it contain Canadian data where relevant? - Is content metricated?
User Support Materials	12.	Are user support materials appropriate for the target audience?
	13.	Are user support materials effective? - Do they contribute to the learning process? - Are these materials sufficient?

C. INSTRUCTIONAL FORMAT

INSTRUCTIONAL FORMAT DESCRIPTION

Write a narrative statement which will describe the following aspects of instructional format.

Instructional Technique

Check the appropriate box(es). A definition of terms is included at the end of the guidebook. Comment on the interaction of the roles if multiple techniques are used.

Student Interaction

Describe the student interaction that is required in the program.

1. What types of student interaction are there? (multiple choice entry, input of answer, "press return", etc.)

2. Comment on the frequency of interaction.

   Example: Student interaction in this program consists of "press space bar" instructions at the bottom of each page (approximately 25) and the input of the number of correct multiple choice responses in the drill section. (5 questions)

   Example: Student interaction in this program consists of menu selections, page turning devices and answer inputs in the drill section. In the menu, the student is asked to enter the name of the program section desired. During the explanation, (10 pages), the student can go forward or backward by using the right or left arrow keys. The drill questions require the student to enter the correct numerical answer along with the % sign.

Questioning Techniques

Describe the manner in which the program selects questions. (For example, randomly, randomly from a limited data bank, in a preprogrammed order, in a predictable sequence, from a teacher created file, etc.)

Feedback Techniques

Describe the feedback techniques. Some questions that may be answered are:

1. When is feedback provided? (after all user responses, when user response is wrong, randomly on correct responses, etc.)

2. What type of feedback is provided? (e.g., graphics, text, audio, combination, etc.)

3. What content is included in the feedback? (e.g., general message, specific hints depending upon the error, the correct answer, a restatement of the correct answer, explanation of incorrect response, presentation of new information, etc.)

4. What is the extent of the variety of the feedback? (e.g., The same phrase "try again" is used after each incorrect response.)

5. Is quantitative feedback provided? (You got 9 questions correct out of 20.)

Example: There are two types of feedback employed. On inputting a correct answer, the student receives a brief congratulatory message chosen randomly from approximately 10 statements. If an incorrect response is entered, the student is first told to "try again". If on the second attempt, (s)he is wrong, the correct answer is shown. Quantitative feedback is given at the end of the drill.

Example: Graphical and audio feedback are employed throughout the program. Correct answers are rewarded with an extensive graphical picture (4 pictures available). Incorrect answers are punished by a buzzing sound and a large "X" which flashes on and off the screen.

Evaluation Techniques

Describe the evaluation techniques that are used to determine the student's success in the program?

1. Is there a pre-test or a post-test?

2. What are the criteria for success? Who sets the criteria?

Note that within this context, a drill is not a test. A drill presents questions, often in a structured way, to give the user practice in a particular skill. Often, more than one attempt at a question is given and hints may also be provided.

A test determines if the practice of the skill, the involvement of the student in the program, has been or is likely to be successful. Questions are not structured to lead a student towards more difficult questions, only one chance is given and feedback is limited to an indication of right or wrong.

Branches

Describe the branches that exist within the program. What types of branches are available to the user? Is the program linearly sequenced or is there provision for review, remediation, enrichment, help, etc.?

Types of Control

Describe the type of control that is used with each of the following: Sequence, Rate and Amount.

There are three types of control - PROGRAM, TEACHER and USER. Program control is based on pre-set criteria built into the program while teacher and user controls are based on entries made during the operation of the program by either the teacher or the student (user).

Sequence refers to the order of the presentation, the path of the user through the branches described above. Under what circumstances does the user enter these branches? For example: Sending a student to a remedial loop automatically if (s)he makes a certain number of errors is program control. User control gives the student the opportunity to go to a particular part of the program, e.g., skip the explanation and go straight to the drill. Teacher control allows the teacher to specify, before a student begins the program, what parts of the program (s)he is to do.

Rate refers to the pace of the presentation, the time allowed to read each display and to answer questions.

Amount refers to the amount of material that is presented in any one branch and how it is controlled. For example, the number of questions done, the number of examples seen, the number of pages read or re-read.

Example:

Sequence-User: The student may elect to skip the instructions and go directly to the drill.

Rate-User:
The pace is controlled by pressing the space bar.

Amount-Program:
All students do 20 questions in the drill. If the instruction section is chosen, all students see the same number of examples and the same number of pages.

INSTRUCTIONAL FORMAT EVALUATION

Write a narrative statement which will evaluate the instructional format described earlier. Some questions to be addressed include:

Instructional Technique

1. Is the instructional technique appropriate for the target audience?

2. Is the instructional technique effective? Is it appropriate for the intents of the program and the composition of the content?

Student Interaction

3. Is the student interaction appropriate for the target audience?

   - Is the type of interaction appropriate?
   - Does the time required to complete the program exceed the attention span of the intended users?

4. Is the student interaction effective?

   - Is there sufficient interaction to meet the intents of the program? Does the student participate or just watch?
   - Is a consistent type of interaction used?

Questioning Techniques

5. Are questions appropriate to the material?

6. Are questions appropriate to the target audience?
7. Are questions effectively randomized where necessary?

   e.g., Are questions posed in an unpredictable pattern?
   e.g., When the program is re-run, will the user receive different questions or a different order of questions?
   e.g., Does the program ensure that a question is not repeated during a drill unless an error is made?
   e.g., If an error is made, is the question re-posed later?

Feedback Techniques

8. Is the feedback appropriate to the target audience?

9. Is the feedback effective?

   - Are user inputs accurately evaluated as right or wrong?
   - Does the feedback distinguish between a wrong answer or the wrong format?
   - Is the feedback non-threatening, immediate and positive?
   - Is the feedback corrective when necessary?
   - Is the feedback relevant to a student's responses?
   - Are traps set to catch potential errors of any kind?
   - Does the feedback explain why a response is wrong?
   - Are cues or prompts used after a wrong response?
   - Is the feedback to a wrong response unnecessarily attractive?
   - Can the user or the teacher control the feedback (e.g., type, amount, when given)?

Evaluation Techniques

10. Is the evaluation technique appropriate to the target audience? Are the criteria for success appropriate for the ability/skills of the intended user?

11. Are the evaluation techniques effective?

   - Is the absence/presence of a post-test appropriate to the intents of the program?
   - If present, does the test measure the user's achievements on all the intents?
   - If present, does the test content accurately reflect the content of the material presented?

Branches

12. Are the branches appropriate to the target audience?

13. Are the branches effective in accommodating individual differences? Should there be more? Less?

Types of Control

14. Are the types of control appropriate to the target audience and are they within their capabilities?

15. Are the types of control effective? Does the user have control of the program when necessary? Can the teacher control the program when necessary?

Other

16. Are vocabulary, sentence structure, sentence length, level of abstraction, and general readability appropriate for the target audience?

D. TECHNICAL DESIGN

Technical Design Description

Write a narrative statement that will describe the following aspects of technical design.

Color, Sound Graphics

Describe the extent to which color, sound and graphics are used. (Indicate if the evaluation was done without a color monitor.)

TECHNICAL DESIGN EVALUATION

Write a narrative statement which will evaluate the technical quality of the program. Some questions to be addressed include:

Displays

1. Are displays appropriate for the target audience?

    - Is character size appropriate?
    - Are upper and lower case letters used where appropriate?
    - Are input methods consistent?

2. Are displays effective?

    - Are they free from grammar, spelling, punctuation and hyphenation errors?
    - Is the amount of material presented at one time appropriate?
    - Is the material clear and easy to read? Is text material too lengthy or wordy? Is there adequate spacing for clarity?
    - Do message design principles place emphasis where the important concepts are? Is scrolling used appropriately so the pertinent information is retained on the screen?
    - Is the transition from display to display smooth, well paced and unobtrusive? Is the user given too little/too much time to read and absorb the information given in each display?

Alberta Education **DISK EVALUATION FORM** Version 1.3

Description

Disk Title: ____________________
Series Title: *(if applicable)* ____________________ Copyright __________
Producer: ____________________
Address: ____________________

	Components	Cost

Telephone No.: ____________________
Subject Area: ____________________
Topics(s) ____________________

Programs included in this Evaluation ____________________

Specified Users: ____________________

Required Hardware and Software:
(in addition to an Apple II, 48K,
Applesoft, 1 Disk Drive, DOS 3.3,
B&W Monitor)

Available in Languages other than English:
____ *No* ____ *Yes (specify)*

Available on: ____________________

DEVELOPER'S RATIONALE (Guidebook, page 13)

SUMMARY OF INTENTS (Guidebook, page 14)

DESCRIPTION OF ENTRY COMPETENCIES (Guidebook, page 14)

EVALUATION OF EASE OF USE BY TEACHER AND STUDENT (Guidebook, page 14)

MANAGEMENT SYSTEM DESCRIPTION (Guidebook, page 15)

Is a management system available on this disk? _____ *on another disk?* _____ *Describe the functions available: (if any)*

Describe the capacity:

MANAGEMENT SYSTEM EVALUATION (Guidebook, page 15)

Alberta Education PROGRAM EVALUATION FORM Version 1.3

PROGRAM NAME(S): TARGET AUDIENCE(S):

INTENTS
objectives: _____ *Stated* _____ *Inferred* *Describe the objectives:* (Guidebook, page 3)

CONTENT DESCRIPTION
Describe the program contents: (Guidebook, page 3)

Describe user support materials (if any): (Guidebook, page 4)

CONTENT EVALUATION (Guidebook, page 4)

INSTRUCTIONAL FORMAT DESCRIPTION

Check the appropriate instructional technique(s) used and comment if necessary: _____*Drill and Practice* _____*Tutorial* _____*Simulation*
_____*Game* _____*Other (specify)*
Comment on the roles if multiple techniques are used.
(Guidebook, page 6)

Describe the student interaction in the program: (Guidebook, page 6)

Describe the questioning techniques in the program:
(Guidebook, page 6)

Describe the feedback techniques used in the program:
(Guidebook, page 6)

Describe the evaluation techniques used in the program:
(Guidebook, page 7)

Describe the branches available in the program: (Guidebook, page 7)

Describe the types of control in the program: (Sequence, Rate, Amount) (Guidebook, page 8)

INSTRUCTIONAL FORMAT EVALUATION (Guidebook, page 9)

TECHNICAL DESIGN DESCRIPTION
Describe the use of color, graphics and sound in the program:
(Guidebook, page 11)

TECHNICAL DESIGN EVALUATION (Guidebook, page 11)

ADDITIONAL COMMENTS
Comment on the motivational aspects of the program and whether it is appropriate to the media: (Guidebook, page 12)

OBSERVATIONS OF STUDENT USERS (if available) (Guidebook, page 16)

DISK CONTENT EVALUATION (Guidebook, pages 4 and 16)

DISK INSTRUCTIONAL FORMAT EVALUATION (Guidebook, pages 9 and 16)

DISK TECHNICAL DESIGN EVALUATION (Guidebook, pages 11 and 16)

DISK EVALUATION: Summational Statement: Major Strengths and Weaknesses (Guidebook, page 16)

RECOMMENDATIONS TO THE PRODUCER (Guidebook, page 16)

RECOMMENDATION

I recommend that _____ *this disk be evaluated further to determine the full nature of its potential use. (Prescribed or Recommended)*

_____ *this disk be considered for "Supplementary" use in the classroom.*

_____ *this disk be rejected.*

I agree that the copyright to this report rests with Alberta Education and confirm that no attempt was made to copy or modify the program or the accompanying documentation.

Name of evaluator: ______________________________

Date: ______________________________

Signature: ______________________________

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Color
Graphics
Sound

3. Are color, graphics and sound appropriate for the target audience?

4. Are color, graphics and sound used effectively?

   - Are they used appropriately for the content materials?
   - Is there an option for the use/non-use of sound? Will the sound distract others in the classroom?
   - Are they appropriately mixed with text so as to give variety to the presentation?
   - Are the graphics boring? Repetitive? Too slow?
   - If color is present, will the program be effective on a non-color monitor?
   - Are they necessary to the instructional format?

Ease of Use

5. Can the intended user easily and independently operate the program?

   - Does the operation of the program interfere with the user's concentration?
   - Is it possible to get lost in the program with no way out?
   - Are instructions available at likely points and are they appropriate for the target audience?
   - Can the user exit the program, return to the menu or move to another section easily when necessary?
   - Is the program reliable and bomb-proof under normal use?

E. ADDITIONAL COMMENTS

Write a narrative statement which will evaluate the motivational aspects of the program and the appropriateness of the media. Provide additional comments as desired.

1. Is the program motivational?

2. Are the content and format appropriate for presentation in this media?

III. DISK EVALUATION FORM

A. DESCRIPTION

This section will be completed by the Clearinghouse. Some of the sections are described below.

Series Title	If the disk being evaluated is part of a series, the name of the series will be entered here (e.g., Milliken Math Sequences).
Copyright	Date of publication.
Components	Other components which are included in the package such as student workbooks or a teacher guide.
Cost	The most recent cost as provided by the publisher. This is subject to change without notice by the publisher.
Publisher Address Telephone	The original source who produced the package. A telephone number is provided (if possible) so that schools may contact the publisher in order to determine if there is a Canadian distributor.
Specified Users	Grade level, grade range or other ability level indicators for which the package has been specifically intended.
Required Hardware & Software	Hardware or software beyond the standard package of 48K, 1 disk drive, 3.3 DOS, B&W monitor.
Programs Included	A list of titles of each program on the disk. One Program Evaluation Form will generally be completed for each title.

B. DEVELOPER'S RATIONALE

What was the developer's stated purpose in designing the programs on the disk? This should not be a statement on the goals or objectives of the program. Rather, the author's intention in writing the courseware should be outlined. In many cases this will not be available in the documentation and it should not be inferred.

Example: This disk is intended to motivate students in their acquisition of basic number facts.

Example: This disk is intended to make certain aspects of classroom instruction as effective in creating persistence and involvement as observed in arcade game players.

Example: The author notes that a great void in quality, Elementary Science courseware exists. This disk is intended to help fill that void.

C. SUMMARY OF INTENTS

Summarize the objectives listed on the program evaluation form(s). If there is only one program on the disk, a repeat of the entry on the program evaluation form is all that is necessary. If there is more than one program, summarize the objectives so that their range is indicated.

D. DESCRIPTION OF ENTRY COMPETENCIES

Describe any special prerequisites that are required beyond the normal grade level skills.

Describe also any student activities that should be completed prior to beginning the work on the diskette.

Indicate if programs on this disk are prerequisites for other programs on the disk.

E. EVALUATION OF EASE OF USE BY TEACHER AND STUDENT

Evaluate how difficult/easy it is for a teacher to use the package. Consider the amount of documentation and support that comes with the package, both inside and outside of the program. Some questions to be considered are:

1. Can a teacher control the pace/difficulty if desired?
2. Do the students require a minimum amount of teacher supervision when using the program?
3. Are error handling and identification procedures sufficiently detailed so that a teacher can help a student?
4. Is the disk adaptable to a variety of classroom learning environments?
5. Does the disk require a minimal amount of equipment manipulation?
6. Can the disk be used by a teacher with a minimum of computer competency?

F. MANAGEMENT SYSTEM

FUNCTIONS DESCRIPTION

Describe the functions available in the management system. These may include:

1. Class lists:
   e.g., initiating, maintaining, adding to, deleting from;
2. Reports:
   e.g., by individual student, by class, by specific unit;
3. Prescription:
   e.g., prescription of specific assignments or a range of assignments for individuals or for the class;
4. Diagnosis:
   diagnosis of a student's weaknesses; and
5. Security:
   passwords, etc.

CAPACITY

How many students can be kept in one class list? How many scores can be kept for one student? How many classes can be kept?

EVALUATION

Write a narrative statement which will evaluate the effectiveness and the ease of use of the management system. Some questions to be addressed include:

1. Do the functions work as described?
2. Is the system effective in meeting the needs of the teacher?
3. How easy is the system to set up and use?
4. Is the capacity sufficient?
5. Is data easily and effectively collected?

G. OBSERVATIONS OF STUDENT USERS

Summarize the results of student use of the disk. This could indicate the evaluator's observation of the user(s) as well as comments and observations made by the user(s). Ensure that identification of the user(s) is made (grade and ability levels).

H. DISK EVALUATION

Evaluative statements in this section cover the entire disk. If there is more than one program on the disk and if two or more Program Evaluation Forms have been completed, this section will include summaries of the evaluative comments made on those forms. If only one Program Evaluation Form has been completed, the reader should be referred to evaluation statements made on that form.

Disk Content - see page 4 of this guidebook.
Disk Instructional Format - see page 9 of this guidebook.
Disk Technical Design - see page 11 of this guidebook.

I. SUMMATION

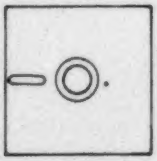
Summarize the strengths and weaknesses of the disk. Considering the comments made in the sections above, what is your evaluation of the entire disk?

J. RECOMMENDATIONS TO THE PRODUCER

Indicate, in priority order, the changes that the producer could make in order to improve the quality of the diskette. Specific suggestions should be made. Comments such as "The package should be redesigned" or "Improve the motivational aspects of the material" are of little use to the producer and should be avoided.

K. RECOMMENDATION

Check one recommendation. See the guidelines for making recommendations on pages 17 and 18.



IV. GUIDELINES FOR MAKING RECOMMENDATIONS

There are no hard and fast rules with which to equate the strengths and weaknesses of a disk to "the correct recommendation". Recommendations are subjective and will vary from one evaluator to another. We hope that the degree of variance will be small and that the process of forming a synthesis from three evaluations will minimize any differences that might occur.

However, to keep these variances small and to strive for consistency across subject and grade levels, it would be advantageous to consider some guidelines.

Within this instrument, there are two questions which have been addressed in almost every evaluation section: 1. the appropriateness to the target audience, and 2. the effectiveness in meeting the intents of the program. A program that is ineffective should be rejected. On the other hand, a program which is inappropriate to its target audience may still be effective with another target audience and could be considered for limited use (supplementary) in the classroom.

What makes a program ineffective or inappropriate? Certainly the degree of the weakness has to be considered. A program should not be rejected because of a minor flaw. The number of weaknesses should also be considered and a program with 4 or 5 minor flaws may have its use restricted because of the cumulative effects of small weaknesses.

Major flaws are those which seriously hinder the learning that is supposed to take place in a program. They are generally in the areas of "content" and "instructional format". Minor flaws are those which may slightly detract from the programs' effectiveness. They are generally in the area of "technical design" or are weaknesses in meeting the needs of the specified users. One minor flaw by itself is not necessarily cause for a lower rating. Several minor flaws should result in a supplementary status and more than 5 (arbitrary figure for the sake of establishing a line) should be cause for rejection.

Examples of major flaws:

1. The sequence of the presentation is ineffective. The program may "hop around" dealing with concepts in a disorganized fashion.

2. The sequence of the presentation may completely miss an important concept which makes all further explanations confusing to the student.

3. The depth of the content may be ineffective. Generally this will happen if the concepts are not given sufficient depth of treament, e.g., one page is given when three are necessary. As a result, the various topics are presented too rapidly and the user has too much material to assimilate at one time.

4. The depth of the content does not include any (or sufficient) practice.

5. There is insufficient student interaction in the program. Generally the program is a "page turner" or it has limited student interaction even in the drill section.

6. The program accepts incorrect answers or rejects correct answers.

7. Feedback does not go beyond indicating if the answer is right or wrong. There is no explanation available as to why an answer may be wrong.

Examples of minor flaws:

1. Material on the screen is cluttered, poorly displayed.

2. Minor spelling or grammatical errors.

3. Insufficient user support materials.

4. Student interaction is not consistent between pushing return or pushing the space bar.

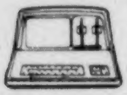
5. Student is not able to control the number of questions in a drill.

6. Sound is distracting.

7. Graphic displays are too slow.

8. Definition of characters is hard for elementary students to read.

9. Language is too difficult for the intended users.



V. NECESSARY FEATURES OF TUTORIAL/DRILL PROGRAMS

The following should be considered as minimum requirements for tutorial and drill and practice programs. Except in exceptional cases, programs which do not have all seven features described below should be rejected.

1. Orderly Structure

   Questions should be posed in an orderly progression so that the student can learn from the drill. This may be achieved by formatting the material into distinct units or by leading the student through a steadily more difficult series of tasks. Drills which "hop around" or which have "quantum leaps" between the tasks should be rejected.

2. Randomization

   A student should be able to redo the drill a number of times. Ideally, the questions should be different each time. If the nature of the material is such that this is impossible, the questions should be drawn from a bank of questions and should be presented in random order.

3. Appropriate Interaction

   In a tutorial, there should be some interaction between the program and the user.

   In a drill, a user will be inputting answers but the type of interaction can limit a drill's effectiveness.

   a) Multiple choice questions can be ineffective if the user can easily guess the answer without having to do the question. For example, in the problem 10048 minus 2197, all alternatives should have a "1" in the last place. If only one answer does, it can be correctly selected without actually doing the question.

   b) Some interactions test the student's ability to type rather than knowledge of the material.

   e.g., having to type in long, complicated words; timed questions where words or long involved numbers have to be entered; allowing a user only one attempt at a question.

4. Immediate Feedback

The student should be made aware immediately if he/she is right or wrong. Passing the student on to the next question in a drill after a correct answer has been entered is appropriate if the student is aware that this is how correct answers are treated. If an answer is wrong, there should be some immediate indication that the student's response was wrong.

5. Accurate Feedback

Programs should accurately assess the student's input. This includes giving the correct answer as well as correctly evaluating a student's input. Ideally the program should also distinguish between an incorrect response and an incorrect format.

6. Quantitative Feedback

A program should give the student (and the teacher) the results at the end of the drill. Ideally, a user should also know how many questions there are in the drill and how many have been done.

7. Restructuring

When an incorrect response or a sequence of incorrect responses has been entered, the student's path through the program should be restructured in such a way that he/she learns why the answer was wrong. This is a critical element in instruction and unfortunately it is often missing in the courseware currently on the market. Something more should happen than telling the student what the answer should have been. Examples of restructuring are:

a) Corrective feedback; hints and cues which direct the student on a second attempt

b) Availability of help pages

c) Remedial loops; a student may be directed to a section of the program where further instruction is given (usually at a lower level) and/or where other drill questions lead the student through his/her weakness.

d) The program may loop back to a previous page and the student then continues from that point. This is not necessarily effective as the original explanation may be the reason for the confusion.

e) The level of difficulty may be changed. This can be effective if the student is brought back up to the desired level.

f) The number of questions may be increased or decreased depending upon the student's achievement.

VI. DEFINITIONS

PRESCRIBED LEARNING RESOURCES are those "learning resources approved by the Minister as being most appropriate for meeting the majority of goals and objectives for courses, or substantial components of courses, outlined in provincial Programs of Study".

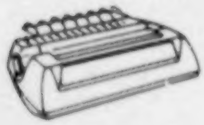
Evaluators do not have to make this recommendation - it is made by the Curriculum Committee. Evaluators just make the recommendation that the courseware is worth looking at by the Curriculum Committee.

RECOMMENDED LEARNING RESOURCES are "those learning resources approved by Alberta Education because they complement Prescribed Learning Resources by making an important contribution to the attainment of one or more of the major goals of courses outlined in the provincial Programs of Study".

As with prescribed materials, evaluators only recommend that specific courseware be examined further. This examination may result in a prescribed status, a recommended status or even a supplementary status.

SUPPLEMENTARY LEARNING RESOURCES are "those additional learning resources identified by teachers, school boards or Alberta Education to support courses outlined in the provincial Programs of Study by reinforcing or enriching the learning experience".

Teachers may identify supplementary resources but this category should not be a dumping ground for all courseware that is less than "Recommended". Courseware in this category should still be effective, it should meet the needs of some target audience (perhaps not the target audience specified) and it should support some of the goals of the curriculum. The range of potential use of the courseware may be limited, but what it does cover, it covers effectively.



VII. GLOSSARY OF TERMS

In the fields of microcomputers and education, terminology can easily be misinterpreted. So that everyone using the Guide will interpret words in the same way, a brief glossary is provided below. Each definition conforms to some standard use of the term but is not necessarily a composite of all uses nor the most common use.

Content	Facts, terms, ideas, concepts, principles, theories and constructs which make up the subject matter of an instructional package.
Courseware	Software and printed materials which support instruction in a complete course of study or a definite subset of a course. In this sense, it is not required that all instructional activities be supported by the package or that the tutorial mode of instruction be employed. Even a 30 minute student activity aimed at one objective can be courseware in this definition.
Documentation	Written material for the teacher to use with the computer program (also called a support booklet).
DOS	"Disk Operating System", an operating system which includes the capability of controlling and coordinating the functions of a disk drive within a computer system.
Drill & Practice Mode	A type of computer program which acts as drillmaster by providing repetitive practice on a skill or set of facts. The mode assumes that instruction in the concept skill or process has already been given. Ideally a drill and practice program should: 1) provide random selection of exercises; 2) record student progress; 3) tailor instructions, exercises and feedback to the individual; and 4) offer corrective feedback upon the input of incorrect responses.
Games	Programs in the instructional gaming mode call upon the user to apply one or more specific skills or concepts within a "game" environment. The game dimension of the environment includes the conditions of competition with self or others, specific (if arbitrary) rules, the need to develop a winning strategy and the introduction of random events to force revision of strategies. The instructional dimension of the environment demands that the development both of identifiable subject matter skills or concepts and of general problem solving skills be a goal of the exercise.
Graphics	Images displayed on a video screen or printer which are generated by a computer program.

Hardware	Equipment, including computers, disk drives, cassette players, cables and monitors.
Materials	Books, folders, envelopes, worksheets and similar items. "User Support Materials" are items which support the activity of a person using a computer program.
Microcomputer	A computer system, including peripheral hardware such as disk drive and monitor, based on a microprocessor (or "chip") and having a typewriter-like keyboard.
Package	One or more computer programs with related materials and the storage medium.
Problem Solver	A type of computer program which processes data for a student defined problem.
Program	A computer program, written in Basic, Pascal, machine code or other computer programming language. The routines and operations which instruct the computer.
Simulation	Programs in the simulation mode attempt to represent key aspects of some environment within which the user will experience the necessity of making decisions and will be informed of the results of his decisions without experiencing the real consequences of possible misjudgements. The time required to develop and use simulations is justified in situations where actual experience is ruled out due to extreme expense, safety consideration or the time required for the actual experience. Simulations include problem solving tasks (e.g., diagnosis of illnesses, genetic experiments, testing theoretical models), procedural tasks (e.g., acid titration, blasting, breeding of organisms), or performances (e.g., control of water pollution).
Software	Computer programs, including courseware, operating systems and languages.
Tutorial	For programs in this mode, the computer assumes the total responsibility for instruction. Tutorials are characterized by a dialogue between the student and the computer in which the direction and the level of the dialogue are shaped by the student's input. Ideally, tutorials should tailor and present instruction to the individual, introduce new concepts, provide exercises and tests, monitor student responses, give immediate reinforcement and corrective feedback, and keep records.

Some definitions in this glossary have been taken from Evaluator's Guide published by MicroSIFT and the Computing Teacher.

MicroSIFT Courseware Evaluation

©Northwest Regional Educational Laboratory, 1980

Package Title ______________________________

Reviewer's Name ______________________________

Version ______________________________

Date of Review ______________________________

1. Rating Scale

RATING					IMPORTANCE			
Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable	Higher	Medium	Lower	
SA	A	D	SD	NA	H	M	L	2. Content is accurate.
SA	A	D	SD	NA	H	M	L	3. The content has educational value.
SA	A	D	SD	NA	H	M	L	4. The content is free of race, ethnic, and sex stereotypes.
SA	A	D	SD	NA	H	M	L	5. The purpose of the package is well-defined.
SA	A	D	SD	NA	H	M	L	6. The package achieves its defined purpose.
SA	A	D	SD	NA	H	M	L	7. Presentation of content is clear and logical.
SA	A	D	SD	NA	H	M	L	8. The level of difficulty is appropriate for the target audience.
SA	A	D	SD	NA	H	M	L	9. Graphics/color/sound are used for appropriate instructional reasons.
SA	A	D	SD	NA	H	M	L	10. Use of the package is motivational.
SA	A	D	SD	NA	H	M	L	11. The package effectively stimulates student creativity.
SA	A	D	SD	NA	H	M	L	12. Feedback on student responses is effectively employed.
SA	A	D	SD	NA	H	M	L	13. The learner controls the rate and sequence of presentation and review.
SA	A	D	SD	NA	H	M	L	14. Instruction is integrated wtih previous student experience.
SA	A	D	SD	NA	H	M	L	15. Learning is generalizable to an appropriate range of situations.
SA	A	D	SD	NA	H	M	L	16. The user support materials are comprehensive.
SA	A	D	SD	NA	H	M	L	17. The user support materials are effective.
SA	A	D	SD	NA	H	M	L	18. Information displays are effective.
SA	A	D	SD	NA	H	M	L	19. Intended users can easily and independently operate the program.
SA	A	D	SD	NA	H	M	L	20. Teachers can easily employ the package.
SA	A	D	SD	NA	H	M	L	21. The program appropriately uses relevant computer capabilities.
SA	A	D	SD	NA	H	M	L	22. The program is reliable in normal use.

23. CHECK ONLY ONE

____ I would use or recommend use of this package with little or no change. (Note suggestions for effective use, next page.)

____ I would use or recommend use of this package only if certain changes were made. (Note changes under major weaknesses, next page.)

____ I would not use this package. (Note reasons under major weaknesses.)

24. If you would consider using this package describe procedures for its effective use in specific classroom settings.

25. List one or two major strengths of the package with supporting comments.

26. List one or two major weaknesses of the package with supporting comments.

27. | | In the box at the left, indicate your overall opinion of this package by writing an integer from 1 to 10 (10 being the high value).

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Educational Software Evaluation Form

©Educational Alternatives, 1981

Program Name______________ Producer______________ Cost__________
Subject Area______________ Reviewer______________ Date__________

1. Describe the intended educational purpose:

2. Instructional Range: Grade levels_________ Ability levels________

3. Instructional Grouping: Individual______ Small group (size)______
Large group (size)______

4. Program uses: Drill and practice_____ Tutorial_____ Simulation_____
Instructional game_____ Strategy game_____
Problem solving_____ Information source_____
Software tool (type)___________ Other ___________

5. Comment on Appropriateness for Instructor:
   - To what extent does the program allow a teacher to adjust for different uses and different users?
   - To what extent does the program require teacher assistance?
   - Is the program educationally appropriate?

6. Comment on Appripriateness for Student:
   - Are the directions clear?
   - Is it developmentally appropriate considering physical, intellectual, and emotional maturity?
   - Would most of your students enjoy using this program?_____ If not, describe those who would.

7. Comment on:
   - The instructional significance of the program:

- The compatability with educational philosophy, teaching style, and curriculum generally encountered by the student:

8. What happens when a student makes a mistake in entering answers?

   What happens when a student makes a mistake in content?

9. Can the student get help from the program?

   Can the student review the instructions once the program has sharted?

10. To what extent is the user given choices?

    To what extent does the user feel in control?

11. Indicate the social characteristics present: a) present and negative, b) present and positive, c) not present.

    competition
    cooperation
    personification of the computer
    moral issues and value judgements
    appropriate inclusion of women and minorities

12. Describe any unintentional learning, both positive and negative:

13. To what extent does the program use the computer's potential for interaction, immediate feedback, animation, color, music, sound, etc.?

14. To what extent does the program offer more than one mode of learning (visual, verbal, numerical, aural) in a way that reinforces and supports the learning focus?

15. In what ways (and under what circumstances) can this program provide students with a more effective learning experience than they could have had without a microcomputer?

16. Briefly support your recommendation for_____ or against_____ purchase of this program by your school system:

NCTM
Software Evaluation Checklist

Program Name:____________ Source:______________________ Cost:________
Subject Area:____________ Reviewer's Name:______________ Date:________

1. Instructional Range

________________________________ grade level(s)

________________________________ ability level(s)

2. Instructional Grouping for Program Use

_____ individual

_____ small group (size: _____)

_____ large group (size: _____)

3. Execution Time

_______________ minutes (estimated) for average use

4. Program Use(s)

_____ drill or practice

_____ tutorial

_____ simulation

_____ instructional gaming

_____ problem solving

_____ informational

_____ other (______________________________)

5. User Orientation: Instructor's Point of View

low high

. . . . . flexibility

. . . . . freedom from need to intervene or assist

6. User Orientation: Student's Point of View

low high

• • • • • quality of directions (clarity)

• • • • • quality of output (content and tone)

• • • • • quality of screen formatting

• • • • • freedom from need for external information

• • • • • freedom from disruption by system errors

• • • • • simplicity of user input

7. Content

low high

• • • • • instructional focus

• • • • • instructional significance

• • • • • soundness or validity

• • • • • compatability with other materials used

8. Motivation and Instructional Style

passive active

• • • • • type of student involvement

low high

• • • • • degree of student control

none poor good

• • • • • • use of game format

• • • • • • use of still graphics

• • • • • • use of animation

• • • • • • use of color

• • • • • • use of voice input and output

none	poor				good	
•	•	•	•	•	•	use of nonvoice audio
•	•	•	•	•	•	use of light pen
•	•	•	•	•	•	use of ancillary materials
•	•	•	•	•	•	use of ______________________________

9. Social Characteristics

present and negative	not present	present and positive	
__________	__________	__________	competition
__________	__________	__________	cooperation
__________	__________	__________	humanizing of computer
__________	__________	__________	moral issues or value judgments
__________	__________	__________	summary of student performance

---

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1. The grade levels and ability levels for a particular program are primarily determined by the concepts involved. Other important factors are reading level, prerequisite skills, degree of student control, and intended instructional use. It is possible for a program to be flexible enough to be used across a wide range of grade levels and ability levels.

2. Some programs are designed for use by individuals. Others have been or can be modified for participation by two or three persons at a time. Simulations or demonstrations often pose opportunities for large-group interaction. A given program may be used in more than one grouping, depending on the instructor.

3. The time required for the use of a program will vary considerably. Include loading time for cassettes. A time range is the appropriate response here.

4. Instructional programs can be categorized according to their uses. Some programs may have more than one use, thus falling into more than one of the following categories:

   Drill or practice: Assumes that the concept or skill has been taught previously.

   Tutorial: Directs the full cycle of the instructional process; a dialogue between the student and the computer.

   Simulation: Models selected, alterable aspects of an environment.

   Instructional gaming: Involves random events and the pursuit of a winning strategy.

   Problem solving: Uses general algorithms common to one or more problems.

   Informational: Generates information (data).

5. These are factors relevant to the actual use of the program from the point of view of an instructor.

   Flexibility: A program may allow the user or the instructor to adjust the program to different ability levels, degrees of difficulty, or concepts.

   Intervention or assistance: A rating of "low" means considerable teacher intervention or assistance is required.

6. These are factors relevant to the actual use of the program from the point of view of a student.

   Directions: The directions should be complete, readable, under the user's control (e.g., should not scroll off the screen until understood), and use appropriate examples.

   Output: Program responses should be readable, understandable, and complete. If in response to student input, the output should be of an acceptable tone and consistent with the input request.

   Screen formatting: The formats during a program run should not be distracting or cluttered. Labels and symbols should be meaningful within the given context.

   External information: A program may require the user to have access to information other than that provided within it. This may include prerequisite content knowledge or knowledge of conventions used by the program designer as well as maps, books, models, and so on.

   System errors: System errors result in the involuntary termination of the program.

   Input: A program should ensure that a user knows when and in what form input is needed. It should avoid using characters with special meanings, restrict input locations to particular screen areas, and require minimal typing.

7. These are matters relevant to the subject-matter content of the program.

   Focus: The program topic should be clearly defined and of a scope that permits thorough treatment.

   Significance: The instructional objectives of the program must be viewed as important by the instructor. Also, the program should represent a valid use of the computer's capabilities while improving the instructional process.

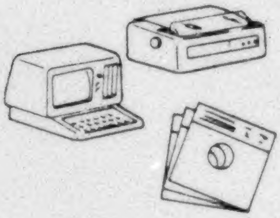
   Soundness or validity: The concepts and terms employed should be correct, clear, and precise. Other important factors are the rate of presentation, degree of difficulty, and internal consistency.

   Compatability: The content, terminology, teaching style, and educational philosophy of the program should be consistent with those generally encountered by the student.

8. Competition, cooperation, and values are concerns that may be a function of the way a program expresses them. (War gaming and the "hangman" format are sample issues.) Also, the "humanizing " of the

computer may serve for motivation or to reduce anxiety, but it also may become tedious, misleading, and counterproductive.

The summary of student performance can be dichotomous (win or lose), statistical (time expended or percent of items correct), or subjective (as in the evaluation of a simulation). It may be for student, teacher, or both.



From "Guidelines for Evaluating Computerized Instructional Materials," by William P. Heck, Jerry Johnson, and Robert J. Kansky. ©1981, by the National Council of Teachers of Mathematics, Inc.

COURSEWARE EVALUATION FORM

Name of Program ____

Manufacturer's or distributor's name ____________________________

Address ____

Cost __________________ Copyright/date ___________________________

Available for what microcomputers (model and memory) _____________

Peripherals needed ____

Reviewer's name ______________________________ Date _____________

Description of program ____

____

____

Appropriate grade level: primary inter. jr high sr high college

Type of computer application(s) (check one or more)

____simulation
____tutorial
____drill and practice
____game
____problem solving
____remediation
____enrichment
____management (only)
____diagnostic/prescriptive
____other ______________________

Kinds of courses for which this program is appropriate

____

Prerequisite skills or courses needed

____

ANALYSIS (check yes, no or not applicable)	YES	NO	NA
a. Content has clear instructional objectives.	____	____	____
b. Content is accurate.	____	____	____
c. Content has educational value.	____	____	____
d. Content is free of stereotypes.	____	____	____
e. Content expresses positive human values.	____	____	____
f. Program is appropriate for targeted audience.	____	____	____
g. Computer branches to appropriate difficulty.	____	____	____
h. Graphics/sound/color have instructional value.	____	____	____
i. Frame display is effective.	____	____	____
j. Students can use program easily.	____	____	____
k. Teachers can utilize the program easily.	____	____	____
l. Documentation is comprehensive.	____	____	____
m. Computer is an appropriate tool for activity.	____	____	____
n. User can control rate/sequence/directions.	____	____	____
o. Feedback used is effective and appropriate.	____	____	____

RECOMMEND FOR PURCHASE? ____yes ____no ____conditional on:

Permission to reproduce for classroom use by Microcomputer Resource Center, Teachers College, Columbia University, New York, New York.

School Microware Evaluation Form

Your Name __________ Organization __________ Position __________

No. of Progs. Under This Name ______ Price $ ______

Product Name __________ Supplier __________

Applicable School Dept/Subj/Topic __________

INSTRUCTIONS - For open ended items, supply all information requested in blanks provided if possible; use extra sheets if necessary. For objective items (those with blanks to left), enter a number in the blank to indicate the extent to which the program fulfills the description in the item, as follows: 2 - Completely, 1 - Partially, 0 - Not at All. If the item is not applicable to the program, enter N/A. If the item is unclear, enter U. Elaborate on answers as necessary in Comments section at end or on extra sheets, giving item numbers.

OVERVIEW - Describe the program briefly in terms of its goals and what it does to achieve them (no evaluation here). __________

____

PRELIMINARY CONSIDERATION - Assuming that this program contributes to the teaching of one or more topics, is that topic one which is or should be taught in today's schools? Yes No If not, give your reasons for this answer in the Comments section at the end of the form and omit the balance of the questionnaire.

DOCUMENTATION - List materials accompanying the program, e.g., teachers guide, student workbook.

1. Indicate types of information included.
    - ____ a. Suggested course/subject, grade levels.
    - ____ b. Goals.
    - ____ c. Performance objectives.
    - ____ d. Suggested teaching strateg(ies).
    - ____ e. Correlation with standard texts.
    - ____ f. Prerequisites for use of program.
    - ____ g. Student exercises, teacher answers.
    - ____ h. Operating instructions.
    - ____ i. Listing and sample runs of program(s).
    - ____ j. If a simulation, description of the model used.
    - ____ k. Suggested topics for follow-up discussions.
    - ____ l. Suggested references/activities for follow-up.

____ 2. The documentation is written clearly.

____ 3. If the workbook is included, the format and content are appropriate.

INSTRUCTIONS GIVEN TO USER BY PROGRAM

1. The instructions are adequate regarding:
    - ____ a. The instructional task to be performed.
    - ____ b. Details of how to interact with the program.

____ 2. User has the option of skipping knstructions if already known.

STUDENT-COMPUTER DIALOG

____ 1. Output is displayed screen by screen (paged) rather than scrolled.

2. If output is paged:
    - ____ a. User has control over continuing to the next page.
    - ____ b. Amount of information in each page is appropriate.
    - ____ c. The perceptual impact (amount of type and lines) is suitable.

_____ 3. Output is spaced and formatted so as to be easily readable.

_____ 4. Language is well suited to most students' reading ability.

_____ 5. Uses correct grammar, spelling, hyphenation, and punctuation.

_____ 6. Any grid or coordinate system used is consistent with common conventions.

_____ 7. Students can respond with common symbols and ways of using them, e.g., right to left entry of sums.

_____ 8. Accepts abbreviations for common responses.

_____ 9. Provides for individual needs, e.g., opportunity to work with harder or easier material.

_____ 10. Dialog is personalized, i.e., makes appropriate use of student names.

_____ 11. Uses devices to get and maintain interest, e.g., variation of computer responses, humor, pace change, surprise.

12. Makes good use of any special features of computer:

    _____ a. Graphics.

    _____ b. Color

    _____ c. Sound

_____ 13. Reinforcing responses (indications of right, wrong, etc.) are appropriate.

_____ 14. The number of wrong answers allowed is reasonable.

_____ 15. Responds appropriately if allowed number of wrong answers is exceeded.

_____ 16. Provides opportunity to get help if difficulty is encountered.

_____ 17. Minimizes bad entries via devices such as objective formats (multiple choice, etc).

_____ 18. Deals well with inappropriate entries, i.e., response to typing errors, etc., is intelligible and useful.

_____ 19. Required entries are within students' capabilities (esp. typing, vocabulary).

_____ 20. Reports student performace periodically and at end of session.

MISCELLANEOUS CONCERNS

_____ 1. If a simulation, the program gives a sufficiently accurate representation of the situation simulated.

_____ 2. The concepts and vocabulary required to use the program are reasonable.

_____ 3. Operates properly and is free of bugs.

_____ 4. Is well structured and documented internally to facilitate any necessary debugging/modifcations.

COMMENTS - Please use this space and additional sheets as necessary to provide any other information which you believe would help someone who was considering acquiring the program being reviewed. In particular, indicate what you like least and most about the program. Also, list any changes which should be made.

____

____

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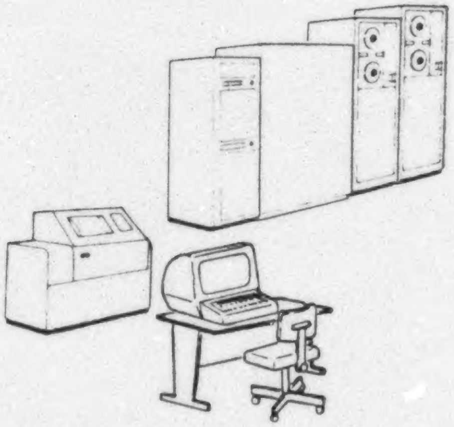

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MICROCOMPUTERS AND EDUCATION
SUGGESTED READING MATERIAL

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MAGAZINES/NEWSLETTERS:

Apple Education News, POB 20485, San Jose, CA 95160.
Apple Educator's Newsletter, 9535 Lucerne, Ventura, CA 93003.
Byte, 70 Main Street, Peterborough, NH 03458
Classroom Computer News, POB 266, Cambridge, MA 02138.
Compute, 900 Spring Garden St., Greensboro, NC 27403.
Computertown USA!! News Bulletin, POB E, Menlo Park, CA 94025.
Computer - Using Educators, Independence High School, 1776 Educational Park Dr., San Jose, CA 95133.
Creative Computing, POB 789-M, Morristown, NJ 07960.
Educational Catalog, 7594 San Remo Tri, Yucca Valley, CA 92284.
Educational Electronics Newsletter, 1 Lincoln Plaza, New York, NY 10023.
Educational Technology, 140 Sylvan Avenue, Englewood Cliffs, NJ 07632.
Educational Technology Center Newsletter, University of California, Irvine, CA 92717.
80-Microcomputing, Pine Street, Peterborough, NH 03458.
Home Computer Newsletter, POB 616, Silverton, OR 97381.
Kilobaud Microcomputing, Pine Street, Peterborough, NY 03458.
Micro Media Newsletter, 686 Sierra Vista Ln., Valley Cottage, NY 10989.
Microcomputers in Education, 5 Chapel Hill Dr., Fairfield, CT 06432
Nibble Magazine, POB 325, Lincoln, MA 01773.
Personal Computing, 1050 Commonwealth Ave., Boston, MA 02215.
Popular Computing, POB 307, Martinsville, NJ 08836.
Recreational Computing, 1263 El Camino Real, POB E, Menlo Park, CA 94025.
Teaching Computer Programming, 1112 Glacial Dr., Minot, ND 58701.
T.H.E. Journal, POB 992, Acton, MA 01720.
T I Source Newsletter, POB 191, Rye, NY 10580.
TRS-80 Microcomputer Newsletter, POB 2910, Ft. Worth, TX 76101.
The Article Index, POB 706, North Plains, OR 97133.
The Computing Teacher, C/O Computer Center, Eastern Oregon State College, La Grande, OR 97850.
The Pocket Computer Newsletter, POB 232, Seymour, CT 06483.

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SOURCES OF INFORMATION:

Association For Computing Machinery, 1133 Avenue of the Americas, New York, NY 10003.
Variety of special interest groups.

Association For Educational Data Systems. 1126, 16th St. NW, Washington DC 20036.

Alameda County Office of Education, Mr. Glenn Fisher, 224 West Winton Ave., Hayward, CA 94544.
OH 44676.
Obtaining and distributing to teachers public domain software. They plan to publish reviews on software.

Apple Computer Clearinghouse for the Handicapped, RD 2, POB 191, Shreve, OH 44675.
Collecting Apple software being developed to aid handicapped people.

Computer Literacy, 1466 Grizzly Park Blvd., Berkeley, CA 94704.
Offers courses in computing to teachers and provides planning for computer education in the schools.

Conduit, P.O. Box 388, Iowa City, IA 52244.
Curriculum materials for microcomputers are available from this research and development center. It reviews, tests, and distributes computer-based instructional materials.

Dataspan, University of Michigan, 109 E. Madison St., Ann Arbor, MI 48104.
Funded by the National Science Foundation this project will develop, disseminate and update an information bank on computer applications in science education.

Eastern Kentucky University, Professor John Wernegreen, Department of Natural Sciences, 200 Memorial Science, Richmond, KY 40475.
Collection and distribution of Apple software for educators.

Florida Educational Computing Project, Department of Education, 109 Knott Building, Tallahassee, FL 23201.
Publishes software evaluations and sponsors computer literacy seminars throughout the state.

Independence High School, Mr. W. Don McKell, 1776 Educational Park Dr., San Jose, CA 95133.
Classroom applications of microcomputers in grades K-12.

Intentional Educations, 51 Spring St., Watertown, MA 02172.
Develops educational software and provides inservice training in educational computing.

Laboratory for Personal Computers In Education, State University of New York, Stony Brook NY 11094. Hold workshops for teachers, contains a variety of personal computers and educational software.

Lawrence Hall of Science , University of California, Berkeley, CA 94720
Offers workshops in Mathematics, Computing and Problem Solving for Teachers.

Math City, 4040 Palos Verdess Dr. North, Rolling Hills Estates, CA 90274.
Teaches classes on computer literacy and computer assisted mathematics instruction.

Microcomputer Education Applications Network, 256 N. Washington, St., Falls Church, VA 22046.
Helps educators develop and sell software.

Microcomputer Resource Center, Teachers College, Columbia University, 525 W. 121 St., New York, NY 10027.
Provides hardware, software, journals and books for use by educators.
It also conducts workshops and seminars.

Miocrosift, Northwest Regional Educational Laboratory, 710 S.W. 2 Ave., Portland, OR 97204.
The focus of this project is on instructional and administrative applications for K-12, with a major emphasis on collection, evaluation, and dissemenation of materials and information.

Minnesota Educational Computing Consortium, 2520 Broadway Dr., St. Paul, MN 55113.
Coordinates the state's educational, computing effort by providing inservice workshops and developing instructional software which it also sells.

National Education Association, 1201 N.W. 16th St., Redwood City, CA 94063.
Offers over 240 public domain instructional programs.

TABS-Math, Dr. S. K. Damarin, The Ohio State University, ARPS Hall 202-A, 1945 N. High St., Columbus OH 43210.
This is a project to develop and disseminate cirricula materials in mathematics.

The North Carolina Instructional Computing Project, 116 W. Edenton St., Education Building, Rm 58, Raleigh, NC 27611.
Provides one-day inservice sessions on microcomputer awareness for the state's teachers and evaluates educational software.

University of Washington Computing Informaiton Center, 3737 N.E. Brooklyn Ave., Seattle, WA 98105.
Contains books, technical reports and periodicals covering all aspects of computing. Specialized bibliographies, references services and borrowing privileges are available.

SOFTWARE DIRECTORIES

Appleseed, Software Publications, 6 South St., Milford, NH 03055.
Creative Publications, POB 103228, Palo Alto, CA 94303.
Datapro Research Corp., 1805 Underwood Blvd. Debran, NJ 08075.
Educational Software Directory, Sterling Swift Publishing Co., POB 188, Manchaca, TX 78652.
Educator's Handbook and Software Directory, Vital Information, Inc., 350 Union Station, Kansas City, MO 64108.
Huntington Computing Catalogue, POB 787, Corcoran, CA 93212.

International Microcomputer Software Directory. Imprint Software, 420 South Howes St., Fort Collins, CO 80521.
K-12 Micro Media. POB 17 Valley Cottage, NY 10989.
March, Inc., 280 Linden Dr., Branford, CT 06082.
Mentor Software, POB 791, Anoka, MN 55303.
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Microcomputer Corporation Catalogue, POB 191, Rye, NY 10580.
Opportunities for Learning, Inc., 8950 Lurline Ave., Chatsworth, CA 91311.
Periodical Guide for Computerists, E. Berg Publications, 622 East 3rd, Kimbal, NE 69145.
Purser's Atari Magazine. POB 466, El Dorado, CA 95623.
Queue, 5 Chapel Hill Drive, Fairfield, CT 06432.
School Microware Directory. Dresden Associates. POB 246. Dresden, ME 04342.
Sharbeks Software Directory, 11990 Dorsett Rd., St. Louis, MO 63043.
Software-Vendor Directory, Micro-Serve, Inc., 250 Cedar Hill Ave., New York, NY 10960.
Teaching Tools Microcomputer Services, POB 12679. Research Triangle Park, NC 27709.
TRS-80 Software Directory, Radio Shack, 1600 One Tandy Center, Ft. Worth, TX 76102.

SOFTWARE SUPPLIERS

Acorn Software Products, Inc., 634 North Carolina Ave. S.E., Washington, DC.
Activity Resources, Inc., POB 4875, Hayward, CA 94540.
Addison-Wesley Publishing Co.,, 2725 Sand Hill Rd., Menlo Park, CA 95610.
Atari, Inc., 1272 Borregas Ave., Sunnyvale, CA 94086.
Avant-Garde Creations, POB 30161, Eugene, OR 97403.
Basics and Beyond, Inc., POB 10, Amawalk, NY 10501.
Bell & Howell, 7100 N. McCormick Rd. Chicago, IL 60645.
Bit'n Pieces Series, POB 7035, Erie, PA 16510.
Bluebird's Computer Software, 2267 23rd St., Wyandotte, MI 48192.
Borg-Warner Educational Systems, 600 W. University Dr. Arlington Heights, IL 60004.
Brain Box, 601 W. 26 St. New York, NY 10003.
California Software, POB 275, El Cerito, CA 94530.
Charles Mann & Associates, 55722 Santa Fe Trail, Yucca Valley, CA 92284.
Comm-Data Systems, POB 325, Milford, MI 48042.
Compak, Inc., POB 14852, Austin, TX 78761.
Compress, POB 102, Wentworth, NH 03282.
Compumax, Inc., POB 1139, Palo Alto, CA 94301.
Computer Action, 45 Paerdegat, 2 St., Brooklyn, NY 11236.
Computer Curriculum Corp., POB 10080, Palo Alto, CA 94303.
Computer Information Exchange, POB 159, San Luis Rey, CA 92068.
Computer Systems Design Group, 3632 Governor Dr., San Diego, CA 92122.
Data Command, 670 W. Broadway, Bradley, IL 60915.
Dynacomp Inc., 1427 Monroe Ave., Rochester, NY 14618.

Education Programs Disney Electronics 6153 Fairmont Ave., San Diego, CA 92120.
Educational Activities Inc., 1937 Grand Ave., Baldwin, NY 11510.
Education Courseware, 3 Napa Lane, Les Port, CT 06880.
Educational Software Exchange Library, 22833 Illinois Ave., South Gate, CA 90281.
Educational Software Library, 262 Park Ln., King of Prussia, PA 19406.
Educational Software Midwest, 414 Rosemere Lane, Maquoketa, IA 52060.
Educational Software Professionals Ltd., 38437 Grand River, Farmington Hills, MI 48018.
Educulture, 1 Dubuque Plaze, Suite 150, Dubuque, IA 52001.
Edu-Soft Steketee Educational Software, 4639 Spruce St., Philadelphia, PA 19139.
Edutek Corp., POB 11354, Palo Alto, CA 94306.
Edu-Ware Services, Inc., 22222 Sherman Way #203, Canoga, CA 91303.
Hartley Software, POB 431, Dimondale, MI 48821.
Hayden Book Co., 50 Essex St., Rochelle Park, NJ 07662.
High Technology Software Products Inc., POB 14665, Oklahoma City, OK 73113.
Houghton Mifflin Co., One Beacon St., Boston, MA 02107.
Information Unlimited Software Inc., 281 Arlington Ave., Berkeley, CA 94707.
Innovative Penguin, 2320 Hampton Dr., Harvey, LA 70058.
Interpretive Education, 2306 Winters Dr., Kalamazoo, MI 49002.
Instant Software Inc., Peterborough, NH 03458.
Instructional Development Systems, 29 Virginia Beach Blvd. Virginia Beach, CA.
J. L. Hammett Co., POB 545, Braintree, MA 02184.
K-12 Micro Media, POB 17, Valley Cottage, NY 10989.
Krell Software, 221 Milbrook Dr., Stony Brook, NY 11790.
Learning Tools Inc., 4 Washburn Place, Brookline MA 02146.
Level IV Products Inc., 32461 School Craft, Livonia, MI 48150.
Math Software, 1233 Blackthron Pl., Deerfield, IL 60015.
McGraw-Hill, 1221 Avenue of the Americas, New York, NY 10020.
MECC Publications, 2520 Broadway Dr., St. Paul, MN 55113.
Med Systems Software, POB 2674, Chapel Hill, NC 27514.
Micro Ed, Inc., Box 24156, Minneapolis, MN 55424. (Pet.)
Micro Learningware, Box 2134, Mankato, MN 56001.
Micro Power and Light Co., 1108 Keystone Park, Dallas, TX 75243.
Microcomputer Software Systems, Inc., 4716 Lakewood Dr., Metairie, LA 70002.
Micrognome, 5843 Montgomery Rd. Elkridge, MD 21227.
Microphys Programs, 2048 Ford St., Brooklyn, NY 11229.
Microsoft Consumer Products, 400 N. E. 108 Ave., Bellevue, WA 98004.
Milleken Publishing Co., 1100 Research Blvd., St. Louis, MO 63132.
Modulo 2 Company, POB 3795, University Park, NM 88003.
Monument Computer Srvices, Village Data Center, POB 603, Joshua Tree, CA 92284.
Muse Software, 330 N. Charles St., Baltimore, MD 21201.
National Software Marketing. 4701 McKinley St., Hollywood, FL 33021.
Nits Software, 680 North Arrowhead Ave., Rialto, CA 92376.

Personal Software, 1330 Bordeaux, Dr. Sunnyvale, CA 94086.
Powersoft, POB 157 Pitman, NJ 08071.
Prescription Learning, 1301 S. Wabash Ave., Chicago, IL 60605.
Program Design, Inc., 11 Idar Court, Greenwich, CT 06830.
Programma International, Inc., 2980 N. Naomi St., Burbank, CA 91504.
Program Store, 4200 Wisconsin Ave., N.W., Washington, DC 20016.
Programs for Learning, POB 954, New Milford, CT 06776.
Quality Education Design, POB 12486, Portland, OR 97212.
Radio Shack Education Division, 1600 One Tandy Center, Ft. Worth, TX 76102.
Random House, High School Division, 2970 Brandywine Rd., Atlanta, GA 30341.
Right on Programs, POB 977, Huntington, NY 11743.
Rite 80 software, 4660 Willens Ave., Woodland Hills, CA 91264.
Roanoke Exchange TRS-80 Instructional Programs, C/O Craig County Public Schools, POB 245, New Castle, VA 24127.
Scott, Foresman & Co., 1900 East Lake Ave., Glenview, IL 60025
Shafer Software, 749 W. Fermon Ave., Sunnyvale, CA 94087.
SRA, 155 North Wacker Dr., Chicago, IL 60606.
Software Exchange, POB 68, Milford, NH 03055.
Software House Inc., 695 East 10th North, Logan UT 84321.
Sterling Swift Publishing Co., 1600 Fortview Rd., Austin, TX 78704.
Teaching Tools: Microcomputer Services, POB 12679, Research Triangle Park, NC 27709.
Texas Instruments, POB 53, Lubbock, TX 79408.
The Alternate Source, 1806 Ada Street. Lansing, MI 48910.
T.H.E.S.I.S., POB. 147, Garden City, MI 48141.
Three R Software, POB 3115, Jamaica, NY 11431.
TYC Software, 40 Stuyvesant Manor, Geneseo, NY 14454.
Tycom Associates, 68 Velma Ave., Pittsfield, MA 01201.
Unicom, 297 Elmwood Ave., Providence, RI 02907.
Weintraub Software, 690 Mountain View Road, El Cajon, CA 92021.
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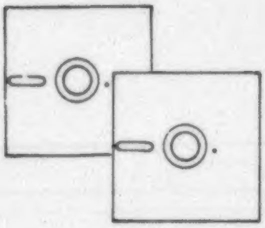
BASIC
Pascal



THE SOFTWARE YELLOW PAGES

A Mini Directory to Software Reviews

Magazines (Review Journals)

Editor's Note: Unless otherwise indicated, journals review software for most microcomputers now popular among educators.

Courseware Report Card

(two editions: K-6 and 7-12) 150 West Carob Street, Compton, CA 90220. (213) 979-1955; (213) 637-2131.

$49.50 for 5 issues/year. Average number of reviews per issue: 20-25. In-depth description and evaluation, including capsule summary rating various aspects of the program from "A" to "F".

Dvorak's Software Review

704 Solano Avenue, Albany, CA 94706.

$5 for 8 issues/year. Average no. reviews per issue: 2-5. North Star software only.

The Apple Journal of Courseware Review

Apple Educational Foundation, 20525 Mariani Avenue, Cupertino, CA 95014. (408) 973-2105.

$5.95 per issue; biannually. Average no. reviews per issue: 20. In-depth critical evaluations with complete descriptions of each program and its potential for effective classroom use. Apple software only. Photographs of actual screens from each program. Available from microcomputer dealers.

Pipeline

Conduit, University of Iowa, Box 388, Iowa City, IA 52244. (319) 355-5789.

$15 for 3 issues/year. Average no. reviews per issue: 8. Primarily college level but useful for advanced high school math and science classes.

Magazines (Review Journals) (Continued)

School Microware Reviews
Dresden Associates, Box 246, Dresden, ME 04342

$40 for 2 issues/year. Offers rating scale 1-10. Apple, PET and TRS-80 software only.

80 Software Critique
P.O. Box 134, Waukegan, IL 60085.

$24 for 4 issues/year. Offers rating scale 1-100.

Other Periodicals

AEDS Monitor
1201 16th Street N. W., Washington, DC 20036. (202) 822-7845.

$15 for 4 issues/year. Average no. reviews per issue: 2. Article "Survey of Commercial Software" by Karen Jostad and Marge Kosel (October/December 1980) surveys 1,225 software programs.

Arithmetic Teacher
National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22901. (703) 620-9840.

$36 for 9 issues/year; $30 membership dues include magazine subscription. Average reviews per issue: 5. Math programs only.

Classroom Computer News
Box 266, Cambridge, MA 02138. (617) 923-8595.

$16 for 6 issues/year. 4-5 fairly extensive reviews per issue. Currently expanding review coverage.

The Computing Teacher
Dept. of Computer & Information Science, University of Oregon, Eugene, OR 97403.

$14.50 for 9 issues/year. Average no. reviews per issue: 8. Often includes reviews produced by MicroSIFT.

Creative Computing
Box 789-M, Morristown, NJ 07690. (800) 631-8112; or in NJ (201) 540-0445.

$24.97 for 12 issues/year. Average no. instructional software reviews per issue: 20. Short descriptions with some critical evaluation.

Other Periodicals (Continued)

CUE Newsletter
c/o Don McKell, Computer-Using Educators, P.O. Box 18547, San Jose, CA 95158.

$6 membership dues includes 6 issues/year. Average no. reviews per issue: 2-6.

Educational Computer
Box 535, Cupertino, CA 95015.

$15 for 6 issues/year. Average no. reviews per issue: 1. A thorough, critical evaluation.

Educational Technology
140 Sylvan Avenue, Englewood Cliffs, NJ 07632. (201) 871-4007.

$49 for 12 issues/year. Average no. reviews per issue: 6. In-depth evaluations, with detailed information on field-testing.

Electronic Learning
902 Sylvan Avenue, Englewood Cliffs, NJ 07632.

$19 for 8 issues/year. Average reviews per issue: 4-6. Each one prepared by teams of curriculum specialists, teachers, administrators, and (where appropriate) students.

EPIE Report
EPIE Institute, Box 620, Stony Brook, NY 11790.

$25 for 18 issues/year; $5 for associate subscriptions, reviews per issue; 5-6. Mostly math in first issue.

InfoWorld
375 Cochituate Road, Box 880, Framingham, MA 01701.

$25 for 51 issues/year. Average no. instructional software review per issue: 5 (July-September only).

MACUL Journal
Michigan Association for Computer Users in Learning, Wayne County, ISD, 33500 Van Born Road, Wayne, MI 48184.

$5 membership dues includes annual issue of reviews which contained 113 reviews in 1980 and 143 in 1981. Plans for 1982 issue indefinite.

Other Periodicals (Continued)

Mathematics Teacher

National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091. (703) 620-9840.
$36 for 9 issues/year; $30 membership dues include subscription. Average no. reviews per issue: 6. Math programs only. Primarily for secondary schools and junior colleges.

Microcomputers in Education

Queue, 5 Chapel Hill Drive, Fairfield, CT 06432.

$24 for 12 issues/year. Average no. reviews per issue: varies. Brief descriptions with occasional critical comments; includes references to software reviews in other journals.

Micro-Scope

Jem Research, Discovery Park, University of Victoria, Box 1700, Victoria, BC V8W 2Y2, Canada. (604) 477-7246.

$10 for 12 issues/year. Average no. reviews per issue: 3-6.

Peelings II

P.O. Box 188, Las Cruces, NM 88001. (505) 526-8364.

$15 for 6 issue/year. Average no. instructional software reviews per issue: 5. Apple software only.

Personal Computing

P.O. Box 2941, Boulder, CO 80321.

$18 for 12 issues/year. Average no. instructional software reviews per issue: 1-2.

Popular Computing

70 Main Street, Peterborough, NH 03458.

$15 for 12 issues/year. Average no. instructional software reviews per issue: 1-2.

Software Review

Microform Review, 520 Riverside Avenue, Westport, CT 06880. (203) 226-6967.

$38 for 2 issues/year; in 1983, $50 for 4 issues/year. Average reviews per issue: 2-6. Very detailed (6-10 pages long); with illustrations.

Other Periodicals (Continued)

T.H.E. Journal
Technical Horizons in Education, P.O. Box 992, Acton, MA 01720.
(617) 263-3607.

$15 for 12 issues/year; free for qualifying educators (administrators or department heads). Listings of newly-released software.

TRS-80 Users Journal
P.O. Box 7112, Tacoma, WA 98407. (206) 759-9642.

$16 for 6 issues/year. TRS-80 software only.

80-Microcomputing
P.O. Box 981, Farmingdale, NY 11737.

$18 for 12 issues/year. Average no. instructional software reviews per issue: 5. TRS-80 software only.

Directories

Editor's Note: While most of the following directories do not include reviews of educational software, they all provide brief descriptions of programs, which may serve as a useful resource to what's available.

The Apple Software Director (Vol. 3, Education)
WIDL Video, 5245 W. Diversey Avenue, Chicago, IL 60639. (312) 622-9606.

$9.95 for a single volume. Educational software from 400 vendors. By subject matter.

The Book of Apple Software (1981 and 1982 Editions)
The Book Company, 11223 S. Hindry Avenue, Los Angeles, CA 90045.
(213) 417-8031. Also available from Addison-Wesley Publishing Co., Reading, MA 01867.

$19.95 per volume. Approximately 50 educational programs reviewd in 1981 edition; 75 in 1982 edition. Paragraph descriptions and numerical ratings. Field-test results. 1983 edition will be available in Oct. 1982.

Directories (Continued)

The Commodore Software Encyclopedia (2nd edition, 1982)
Commodore Corporate Offices, Education Dept., 487 Devon Park Drive, Wayne, PA 19087. (215) 687-9750.

$9.95; available at local Commodore dealers or from software publishers. Special education section lists approximately 740 programs from various software publishers. Only Commodore-approved software listed; for Commodore microcomputers only.

Educator's Handbook and Software Directory
Vital Information, Inc., 350 Union Stn., Kansas City, MO 64108. (913) 381-1818.

$19.95; also available at local Apple dealers. Contains special section of articles on using microcomputers in education. For Apple microcomputers only.

GAMCO Microcomputer Software
Box 310P, Big Spring, TX 79720-0120 (915) 267-6327.

Free. Contains lists and descriptions by microcomputer and subject area. For Apple, PET, TRS-80.

Index to Computer Based Learning (1981)
Edited by Anastasia Wang, Educational Communications Dept., U. of Wisconsin, P.O. Box 413, Milwaukee, WI 53210. (414) 963-5478.

$48 for 4 volumes (postage paid); $15 for microfiche. Lists over 4800 computer-based learning programs.

International Microcomputer Software Directory
Imprint Software, 420 S. Howes Street, Ft. Collins, CO 80521. (800) 525-5992.

$29.95. Lists, cross-references over 5000 programs.

Reference Manual for Instructional Use of Microcomputers (Vol. 1)
Jem Research, Discovery Park, U. of Victoria, P.O. Box 1700, Victoria, BC V8W 2Y2, Canada. (604) 477-7246.

$75. Cross-references over 1000 educational software programs; some programs are evaluated, in addition. Includes index of journals, books, etc.

Directories (Continued)

School Microware Directory
Dresden Associates, P.O. Box 246, Dresden, ME 04342.

$25. Programs for TRS-80, PET, Atari and Apple II are briefly described. By grade level, subject area, and computer system.

The Software Directory
Software Central, P.O. Box 30424, Lincoln, NE 68503.

Includes a special section of educational software; programs are briefly described.

Starbeks Software Directory
11990 Dorsett Road, St. Louis, MO 63043. (314) 567-7180.

$11.95. Includes 300 educational programs for Apple only.

1982 Swift's Directory of Educational Software, Apple II Edition
Sterling Swift Publishing Co., 1600 Fortview Road, Austin TX 78704. (512) 444-7570.

$14.95; available at computer stores. For Apple only.

Texas Instruments Program Directory
TI, P.O. Box 53, Lubbock, TX 79408. (800) 858-4565.

Free. Lists software from TI and other independent companies. Special education sections.

The TRS-80 Sourcebook and Software Directory
Available at local Radio Shack stores.

$2.95. Special education section. TRS-80 software only.

VanLoves Apple II/III Software Directory
Vital Information, Inc., 350 Union Stn., Kansas City, MO 64108. (913) 381-1818.

$19.95. Includes educational software section.

Catalogs

American Peripherals
122 Bangor Street, Lindenhurst, NY 11757. (516) 226-5849.

Free. Two editions; one lists 1200 educational programs for PET, the other lists 400 for VIC-20. 1983 Edition published this fall.

Catalogs (Continued)

Atari Program Exchange

Atari, Inc., P.O. Box 427, 155 Moffett Park Drive, B-1, Sunnyvale, CA 94086.

$1; quarterly editions. Atari's compilation of user-written software. Includes special education section.

CIE Software News

Computer Information Exchange, Box 159, San Luis Rey, CA 92068. (714) 757-4849.

Free. A newsletter with a continuously updated directory of software, books and hardware news.

Curriculum Product Review

530 University Avenue, Palo Alto, CA 94301. (415) 321-1770.

Free (sent out to all school districts). Lists texts, AV materials, hardware and software.

Huntington Computing Catalog

P.O. Box 1297, Corcoran, CA 93212. (800) 344-5106.

Free. Lists educational and noneducational programs.

Instant Software

80 Pine Street, Peterborough, NJ 03458. (800) 258-5473 or in NH 1 (924) 7296.

Free. For TRS-80, Apple, PET, TI-99/4 and Atari 800 microcomputers.

K-12 Micro Media

172 Broadway, Woodcliff Lake, NJ 07675. (201) 391-7555.

Free. Money-back guarantee.

Marck

280 Linden Avenue, Brandon, CT 06405. (201) 481-3271.

Free. Lists by computer, subject area and publisher. All software listed tested by Marck. Apple, Atari, PET and TRS-80 software only.

Catalogs (Continued)

User's
2520 Broadway Drive, St. Paul, MN 55113. (612) 376-1118.

Free. Lists Apple and Atari software developed by educators for the Minnesota Educational Computing Consortium (MECC).

Micro Co-op Newsletter
P.O. Box 432, West Chicago, IL 60815. (312) 232-1984.

$3/year fee includes this bimonthly newsletter which provides software listings and descriptive comparisons of programs.

Microcomputers Corporation Catalog
34 Maple Avenue, P.O. Box 8, Armonk, NY 10504. (914) 273-6480.

Free. Listing of computer accessories and software; many programs are educational.

Opportunities for Learning, Inc.
Dept. L-4, 8950 Lurline Avenue, Chatsworth, CA 91311. (213) 341-2535.

Free. Elementary through college level.

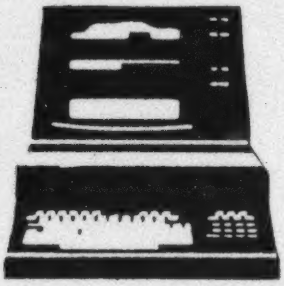
Queue
5 Chapel Hill Drive, Fairfield, CT 06432. (203) 335-0906.

Free. Programs come from over 40 educational software publishers. By subject and grade level.

Scholastic Microcomputer Instructional Materials
904 Sylvan Avenue, Englewood Cliffs, NJ 07632. (201) 567-7900.

Free. All programs have passed educator evaluation tests; money-back guarantee.

GLOSSARY



GLOSSARY

ACCESS TIME: Average amount of time required to retrieve a quantity from storage location.

ACCUMULATOR: A high speed, low capacity storage register where calculations take place in the arithmetic unit of the computer.

ADDRESS: The numbered location of a unit of memory.

ALGORITHM: A well-defined mathematical or logical solution of a problem in a finite number of steps.

ARITHMETIC UNIT: The part of the computer in which all arithmetic operations (addition, subtraction, multiplication, and division) are performed with the result being temporarily stored in the accumulator.

ASSEMBLY LANGUAGE: A programming language comprised of easy to remember codes which control the most primitive actions of the computer.

AUXILIARY STORAGE: A storage device accessible to the computer processing circuits used to supplement the primary storage.

BASIC (Beginners All-purpose Symbolic Instruction Code): A simple programming language.

BINARY: A number system whose base is 2 (therefore the only symbols are 0 and 1). A number system designed for electronic computers which only have two states, on and off.

BIT (Binary digIT): Smallest unit of information recognized by the computer.

BUG: A mistake.

BYTE: A sequence of bits acted on as a unit.

CAPACITY: Amount of data that can be stored in a computer storage system, related to the size of memory.

CENTRAL PROCESSING UNIT (CPU): The "heart" of a general purpose computer which controls interpretation and execution of instructions, input, and output.

CHARACTER: Any symbol, digit, letter, or special mark processed by a digital computer.

CHIPS: Microprocessors that are complex computers on a single piece of silicon.

COBOL (COmmon Business Oriented Language): A high level programming language suited to business data processing.

COMMAND: A signal or group of signals that cause a computer to perform one operation.

COMPUTER ASSISTED INSTRUCTION (CAI): The use of computers to interact with students in the instructional process, such as with drill and practice, exercises, testing, or presenting new topics.

COMPUTER LITERATE: The state of having sufficient knowledge about computers to use them, to understand the social impact, and to know the many ways in which they are used by others.

COMPUTER MANAGED INSTRUCTION (CMI): The use of computers to aid in managing the instructional sequence, but not necessarily in instruction itself. Such a system typically is used to test student performance and in some cases, prescribe units of study for individual students.

COMPUTER OPERATOR: A person who operates the physical equipment of a computer system.

COURSEWARE: Computer programs written especially for educational applications.

DATA: Coded information.

DATA BANK: A comprehensive collection of libraries of data.

DATA BASE: A collection of data fundamental to a system.

DEBUGGING: The detection, location, and removal of mistakes from a computer program.

FILE: A collection of related records treated as a unit.

FLOPPY DISK: A small inexpensive magnetic disk unit in which the individual platters are made of vinyl plastic. The self-lubricating properties permit constant physical contact between the recording heads and the surface of the disk.

FLOWCHART: A sketch made up of boxes of various shapes connected by arrows which portrays the structure of a computer program.

FORMAT: A predetermined arrangement of information usually in a file.

FORTRAN (FORmula TRANslation): A symbolic computer programming language used primarily for scientific application because the expressions resemble algebraic expressions.

GARBAGE: Unwanted or meaningless information stored within a computer file.

HARD COPY: A readable machine output on paper.

HARDWARE: The physical equipment in a data processing center or computer system.

INPUT DEVICE: A device used to communicate information to the computer, such as a card reader, terminal, or an optical scanning device.

INTERACTIVE: A computer system which provides immediate response and allows immediate reaction by the person using the system.

KEYWORD: A significant or informative word in a title or document that describes its content.

LOAD: The action of placing a program or data into the memory of computer.

LOGO: A powerful, but simple to use, programming language developed at Massachusetts Institute of Technology for the purpose of teaching young children how to program.

LOOP: To repeat, automatically under program control, the same sequence of steps until a predetermined stop or condition occurs.

MACHINE LANGUAGE: A code, usually in binary digits, used to directly operate the computer.

MAINFRAME: The central processor of a computer system containing main storage, arithmetic unit, and special registers.

MEMORY: The part of a computer where information and programs are stored and manipulated.

MENU: A list of possible operator actions supplied by the software system for selection.

MICROCOMPUTER: A small, self-contained digital computer whose mainframe is made of integrated circuits.

MICROPROCESSOR: An integrated circuit component that contains the logic of a complete central processing unit.

MODEM: An electronic device which converts data into a form which can be transmitted over a data phone line.

NETWORKING: Hooking together geographically separated computers over transmission lines, thus allowing them to communicate data and programs to each other.

NUMBER SYSTEM: The method used to represent quantities by a system.

OFFLINE: Equipment not under the control of the CPU.

ON-LINE: Equipment which is under the control of the CPU, and has the ability to interact with the computer, usually by a terminal.

OUTPUT DEVICE: A device used to present information from within the computer memory to the user, such as a printer or a screen.

PROGRAM: A set of instructions arranged for directing digital computers to perform desired operations.

PROGRAMMING LANGUAGE: Any well-defined language used in preparing instructions for computer execution.

RANDOM ACCESS DEVICE: Any computer storage device in which the time required to retrieve a particular data value is not significantly affected by its physical location, similar to finding a song on a record.

READ ONLY MEMORY (ROM): A memory in which the information is stored at the time of manufacture. The information can only be modified with great difficulty.

SOFTWARE: Programs including systems, library routines, and other service programs that govern the operation of a computer.

SORT: To arrange data in an ordered sequence.

STORAGE: Computer oriented medium in which data is contained.

TERMINAL: A point in a system where the data can be entered or received.

TIME SHARING: Occurs when a computer's time is sequentially apportioned among several different users. The response time is so short that each user seems to have a dedicated computer.

UNIVERSAL IDENTIFICATION NUMBER (UID): A number which would be necessary for identifying an individual in a computerized society.

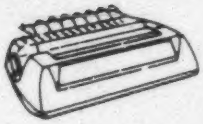
USER: A person who uses or interacts in some way with a computer or computer system.

VARIABLE: A symbol or mnemonic given within a computer program representing a location that may change in value during the execution of that program.

VIDEO-DISPLAY TERMINAL (VDT): A display screen that allows keyed or stored information to be viewed for reading or editing.

WORD: One unit of addressable memory used to store an instruction or piece of data.

WORD PROCESSING: Transition of written, verbal, or recorded word to verbal, typewritten, or printed form through a storage medium that allows information to be manipulated before it is committed to final form.



EVALUATION

This publication can become one of the most useful tools available to you as a teacher. To insure its usefulness we would like to ask your assistance in continually improving the quality of this product. Would you please help us by responding to the following?

Name______________________________ School______________________________

Address__________________________ City______________________________

1. Circle grade level taught: K 1 2 3 4 5 6 7 8 9 10 11 12

2. Teaching area:____

3. Secondary, Middle, Elementary:_____________________________________

4. Was the content of this publication generally appropriate for your subject and grade level? _____yes _____no

5. Was the information: _____most helpful _____of some help
   _____of no help

6. What, in your opinion, is the major strength of this publication?
   ____
   ____

7. What, in your opinion, is the major weakness of this publication?
   ____
   ____

8. What are some other types of microcomputer publications or products that would be of use to you?______________________________________
   ____

9. Comments or suggestions:____
   ____

Please return to: Instructional Computer Resource Section
State Department of Education
2500 North Lincoln
Oklahoma City, Oklahoma 73105